TECHNICAL EXAMINATION ENVIRONMENTAL ASSESSMENT

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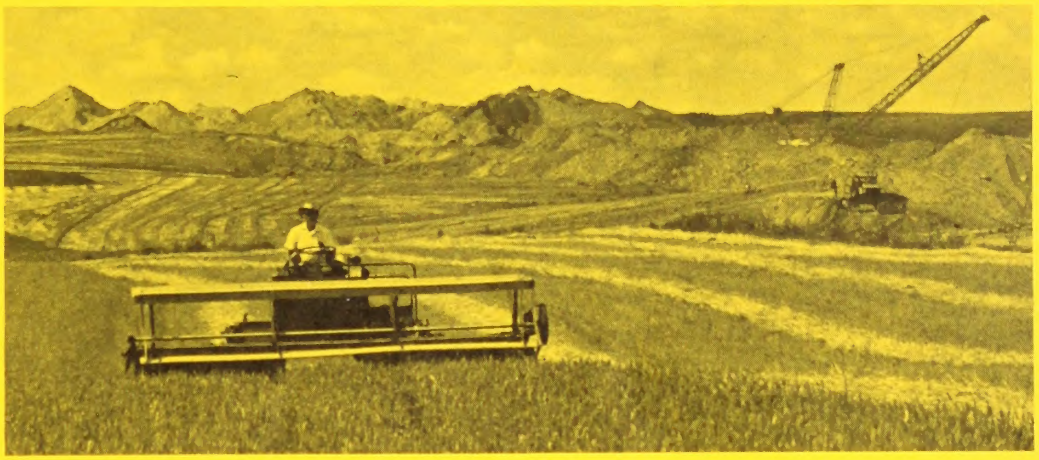

GLENHAROLD MINE

United States Department of the Interior
Bureau of Land Management

State of North Dakota

U.S. DEPARTMENT OF THE INTERIOR

STATE OF NORTH DAKOTA

DRAFT

TECHNICAL EXAMINATION
ENVIRONMENTAL ASSESSMENT

CONSOLIDATION COAL COMPANY'S
GLENHAROLD MINE

Prepared by Personnel From

Federal Agencies

Bureau of Land Management
Geological Survey
U.S. Fish and Wildlife Service
Bureau of Mines
Energy Research and Development Administration
Soil Conservation Service
Bureau of Reclamation
Agricultural Research Service

State Agencies

N.D. Agriculture Department
N.D. Game and Fish Department
Governor's Office
N.D. Health Department
N.D. Highway Department
Indian Affairs Commission
Natural Resources Council
N.D. Outdoor Recreation Agency
N.D. Public Service Commission
N.D. Tax Department
Water Commission

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State Director, BLM
Montana, North Dakota & South Dakota

Arthur A. Link
Governor of North Dakota

SUMMARY

(X) Draft ( ) Final TEEA

1. Type of Action
   (X) Administrative ( ) Legislative

2. Description of the Action: The proposed action is to lease competitively 1,668 acres of federal coal under the short-term criteria defined in the NRDC vs. Hughes amended court order. The short-term application is within the existing Glenharold Mine near Stanton, North Dakota.

3. Summary of Environmental Impacts

Impacts associated with the short-term lease application area are similar to those occuring in the ongoing mining operation. In general, the aeral and temporal extent of the impacts would be increased but the overall severity would remain about the same.

A. Mining of federal coal would not contribute to overall ambient air quality loading of particulates above what is occuring from the existing Glenharold mining operation. Existing air quality from mining would continue for an additional five years.

B. At an 85% recovery rate, approximately 17.8 million tons of coal would be mined leaving behind little over 3 million tons of unrecoverable coal. Layering, compactness, and cohesion of 980 acres of bedrock up to 110 feet in thickness would be obliterated. Fossils not detected and preserved would be destroyed.

C. Soil productivity would be lost on more than 1,000 acres until a vegetation cover is reestablished. Soil loss from water and wind erosion could be significant in highly susceptible areas. Subsidence and piping would be a significant concern throughout the area.

D. Prior to complete rehabilitation surface runoff from the mine would carry greater volumes of sediment than normal. Some of the existing ground water seepage into drainages would be eliminated.

E. An estimated loss of 1,436 bushels of wheat and 2,300 animal unit months of livestock forage would occur during mining representing an agricultural loss of $190,000.

F. Wildlife populations would be reduced 20 to 25% for the duration of mining. Wildlife appreciation and hunting opportunity losses would occur during mining and early reclamation.

G. The quality of recreation experiences at the Knife River Indian Villages National Historic Site would continue to be degraded due to the sights and sould of mining for an additional five years.

H. Visual intrusions from spoil ridges, stockpiles, highwalls, and draglines would be noticeable along the skyline and most severe from highways 200A and 31 during mining. Blasting and other mine associated noise would be noticed by Stanton residents and travelers.

I. Three historic sites would be wholly or partially destroyed. Once destroyed no further information can be obtained from the sites.

J. Mining of the federal coal would allow continued significant revenues for the state of North Dakota for an additional five years.

4. Alternatives Considered:

A. Termination of mining.

B. Continued mining without federal coal.

C. Leasing at a later date.

D. Regulatory options by government.

E. Other options.

5. Comments on the draft technical examination and environmental assessment have been requested from various agencies, interest groups, and the public.

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Introduction

INTRODUCTION

On December 4, 1978, the Consolidation Coal Company submitted a short-term coal lease application in response to the requirements defined in the amended NRDC vs. Hughes court order of June 14, 1979.

Prior to the Bureau of Land Management taking action on the short-term lease application, an environmental assessment must be written. The federal coal requested in the short-term application is scattered throughout the existing project area. Therefore, in order to provide a better context in which a valid leasing decision can be made, the mining proposal for the entire project area has been analyzed as well as the areas identified in the short-term lease application.

When the Department of Interior's new federal coal program has been adopted, the BLM's Land Use Analysis process can be completed on the remaining federal coal not included in the short-term application area.

In the spirit of the January 1975 Memorandum of Understanding committing the State of North Dakota and the Montana State Office of the Bureau of Land Management to cooperation in planning and environmental areas, this Technical Examination and Environmental Assessment (TEEA) was written as a joint federal and state effort.

The objective of the TEEA is to disclose to the state and federal managers and the public the probable environmental impacts and alternatives, in order to assure that these factors are considered in the decisionmaking process.

Chapter I

Description of the Proposed Action

The proposed action is the competitive leasing, for the purpose of surface mining, of 1,668 acres of federal coal under the short-term criteria defined in the amended court order in NRDC vs. Hughes.

The application area falls within the existing Glenharold Mine and the Knife River known recoverable coal resource area (KRCRA) near Stanton, North Dakota (Map 1-1).

AUTHORIZING ACTIONS

The Bureau of Land Management issues leases for federal coal for the Department of the Interior. Should a decision to lease the coal in a short-term lease application area be made, the BLM would develop special requirements for protection of resources other than coal and for the post-mining use of the affected lands. These special requirements would be included in the federal coal lease and reclamation plans.

Any company involved in the surface mining of coal must comply with applicable federal and state regulation. Mining and reclamation plans must meet the appropriate standards of the North Dakota Century Code. Mining permits must be obtained from the North Dakota Public Service Commission and construction permits are required by the North Dakota State Department of Health.

Mining and reclamation plans must also meet the requirements of the federal Surface Mining Control and Reclamation Act of 1977 (PL 95-87 and the subsequent regulations and 30 CFR parts 700 and 800). Mining and reclamation plans are reviewed and approved by the Office of Surface Mining, Reclamation and Enforcement in consultation with the State of North Dakota. Where federal coal is involved, additional consultation with the Bureau of Land Management and Geological Survey is required.

The Consolidation Coal Company has applied for additional federal, state, county, and private coal leases and permits to allow the continued mining of approximately 3.7 million tons of lignite annually from the Glenharold Mine. Map 1-2 shows existing state mining permits.

Conditional use permits for various parts of the mine must be issued by Mercer and Oliver County Boards of Commissioners.

BACKGROUND

The Consolidation Coal Company has requested a short-term lease under the amended NRDC vs. Hughes Court Order of June 14, 1978, through a December 4, 1978, lease amendment to their 1972 lease application. The company has stated in the amended lease application that the identified federal coal would likely be by-passed if not leased and mined now or in the near future and that the coal cannot be mined at a later date without significant environmental damage.

The Geological Survey and Bureau of Land Management evaluated the December 4 amended lease application requesting 1,863.73 acres. Several of the tracts are in danger of being completely isolated if they are not mined in conjunction with ongoing surface operations. It was determined that the 275.65 acres applied for in T. 143 N., R. 84 W., Sec. 6, would not meet short-term leasing criteria.

An additional 80 acres in T. 144 N., R. 85 W., Sec. 24, were added in order to encourage maximum economic recovery and use of coal resources. The following legal description identifies the 1,668.08 acres that meet the short-term criteria and that are being analyzed as the short-term lease application:

T. 144 N., R. 84 W., 5th P.M., Sec. 18, Lot 4

T. 144 N., R. 84 W., 5th P.M., Sec. 20, SW¼SE¼

T. 144 N., R. 84 W., 5th P.M., Sec. 30, Lots 3, 4, E½SW¼, SE¼

T. 144 N., R. 84 W., 5th P.M., Sec. 32, N½N½

T. 144 N., R. 85 W., 5th P.m., Sec. 14, S½N½, S½

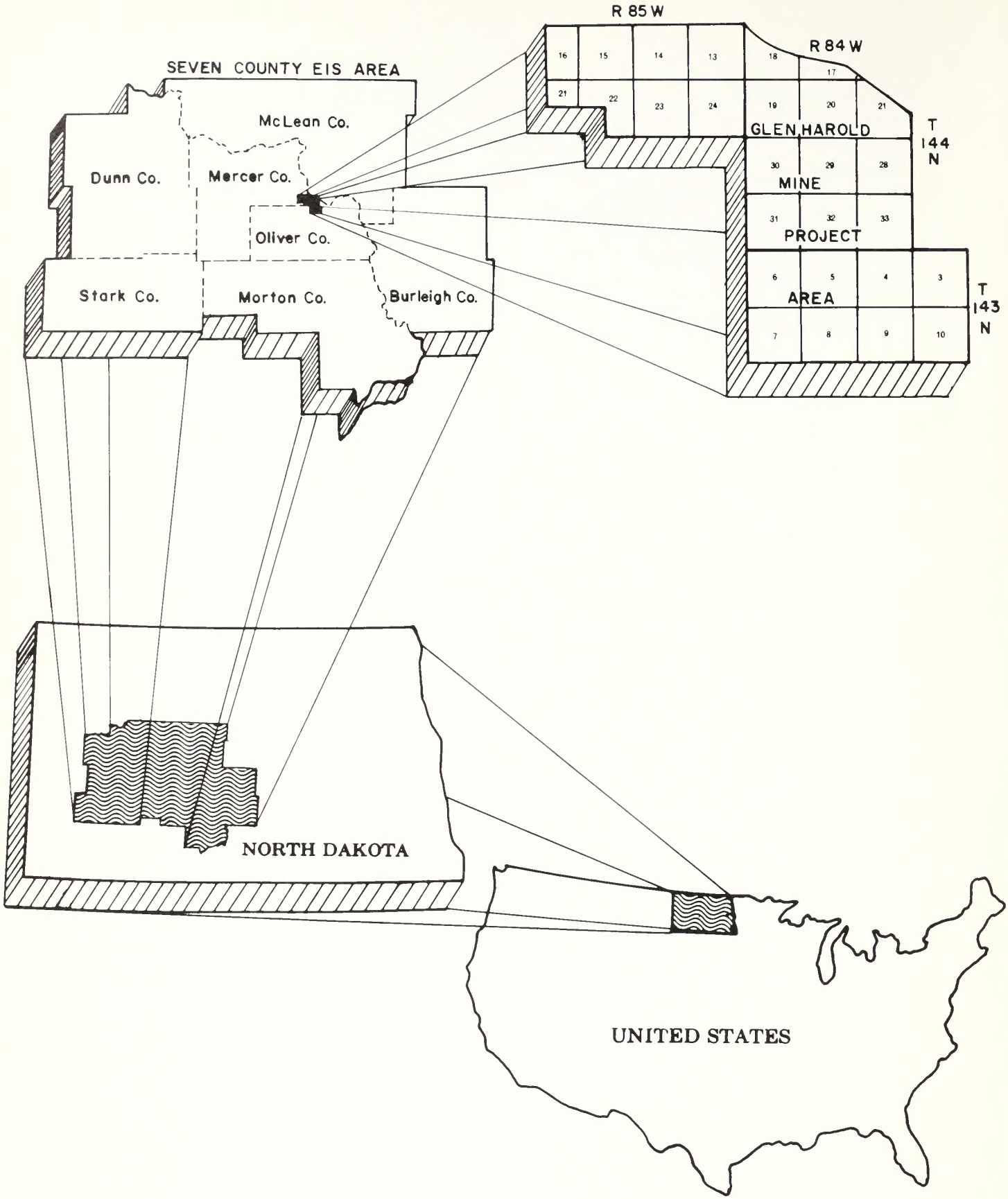
T. 144 N., R. 85 W., 5th P.M., Sec. 22, S½NE¼

T. 144 N., R. 85 W., 5th P.M., Sec. 24, N½, NW¼, N½SE¼

See Overlay 1, Map 1-3, for the location of these land descriptions.

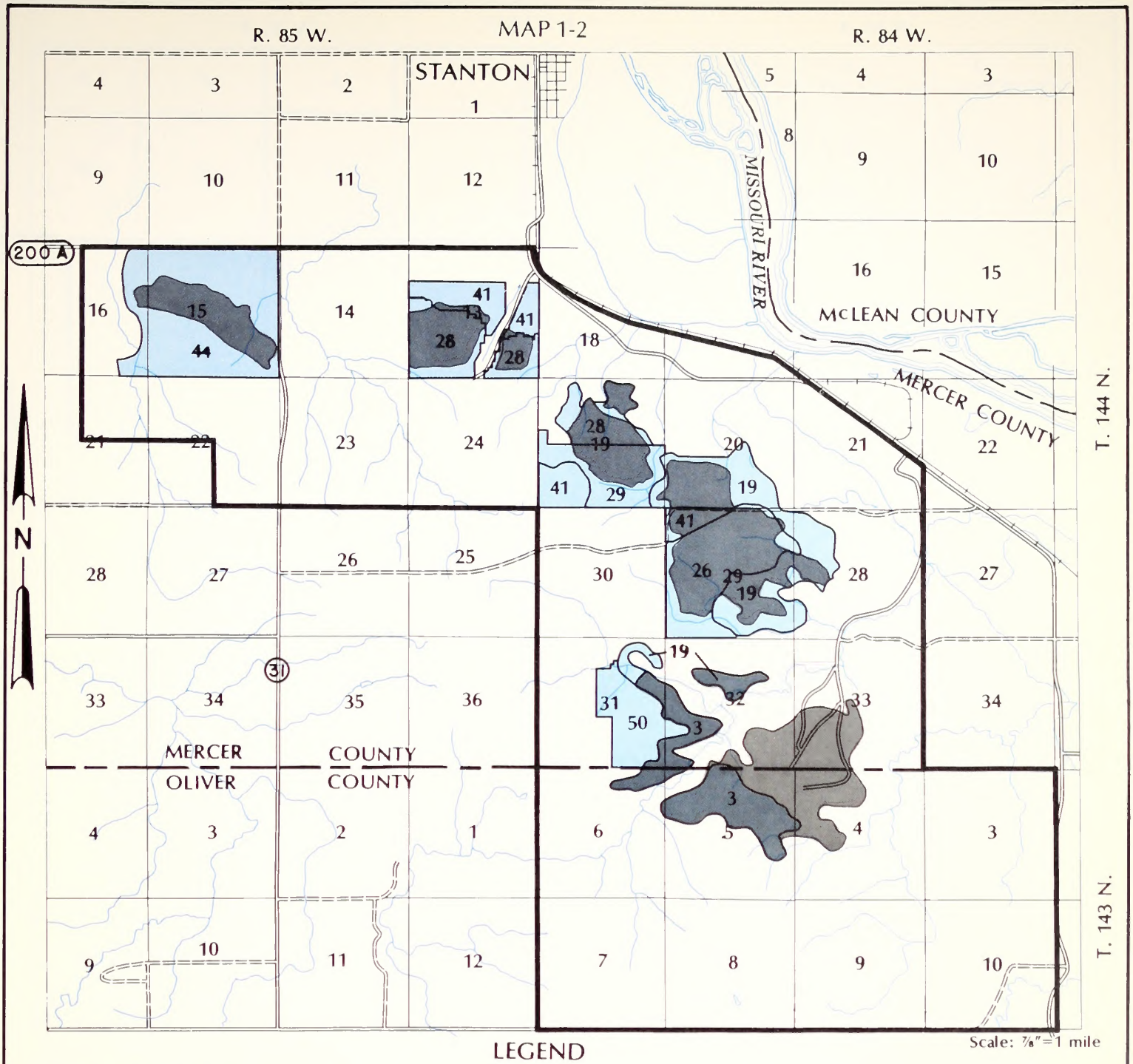
Federal coal must be leased competitively. It is possible that someone other than the applicant may obtain a short-term lease. In order for someone other than the applicant to obtain a lease, they would have to meet the court order conditions for by-pass or maintenance of production.

MAP 1-1



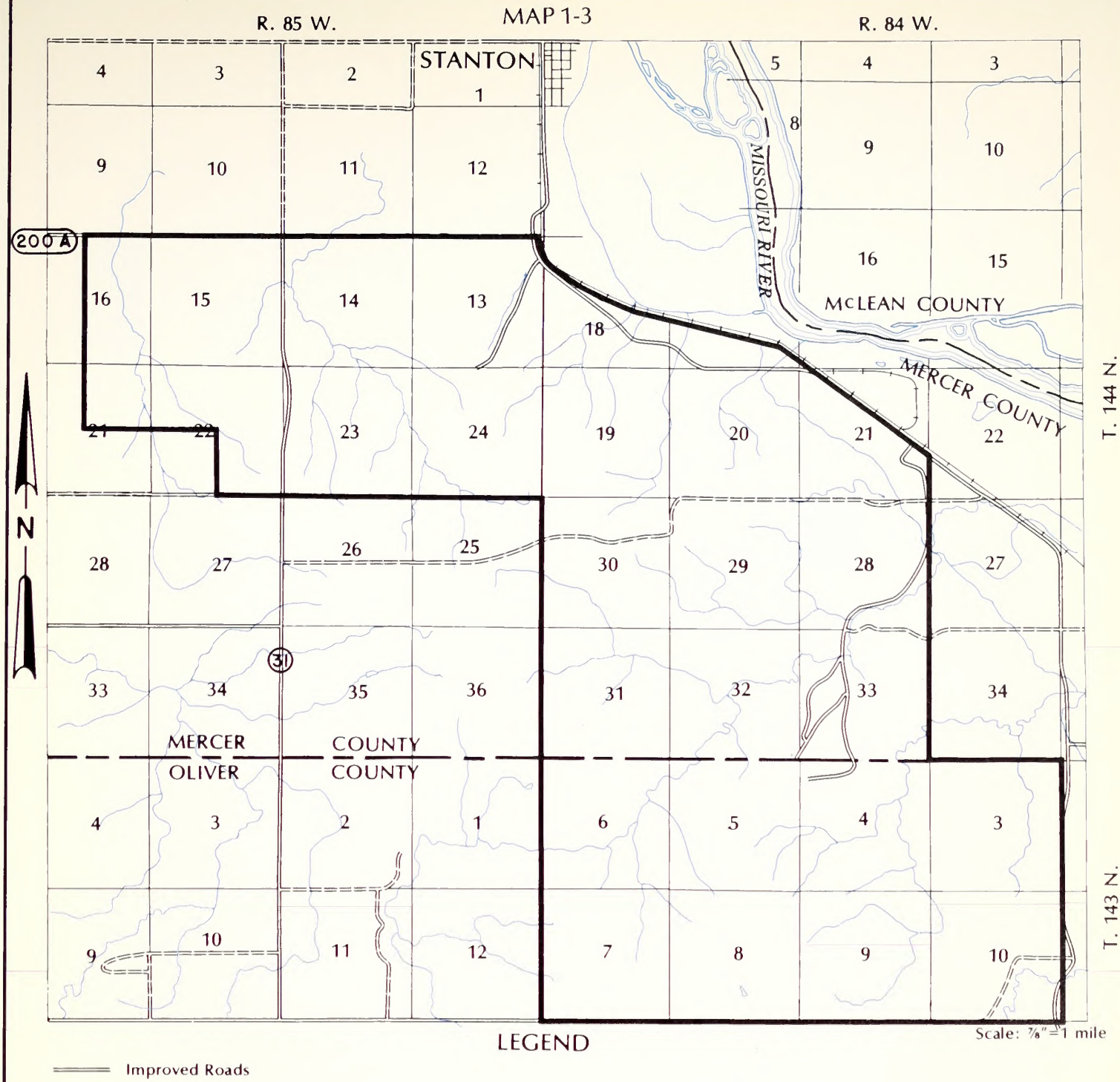
SOURCE: BLM, 1977

LOCATION OF GLENHAROLD MINE



EXISTING STATE MINING PERMITS

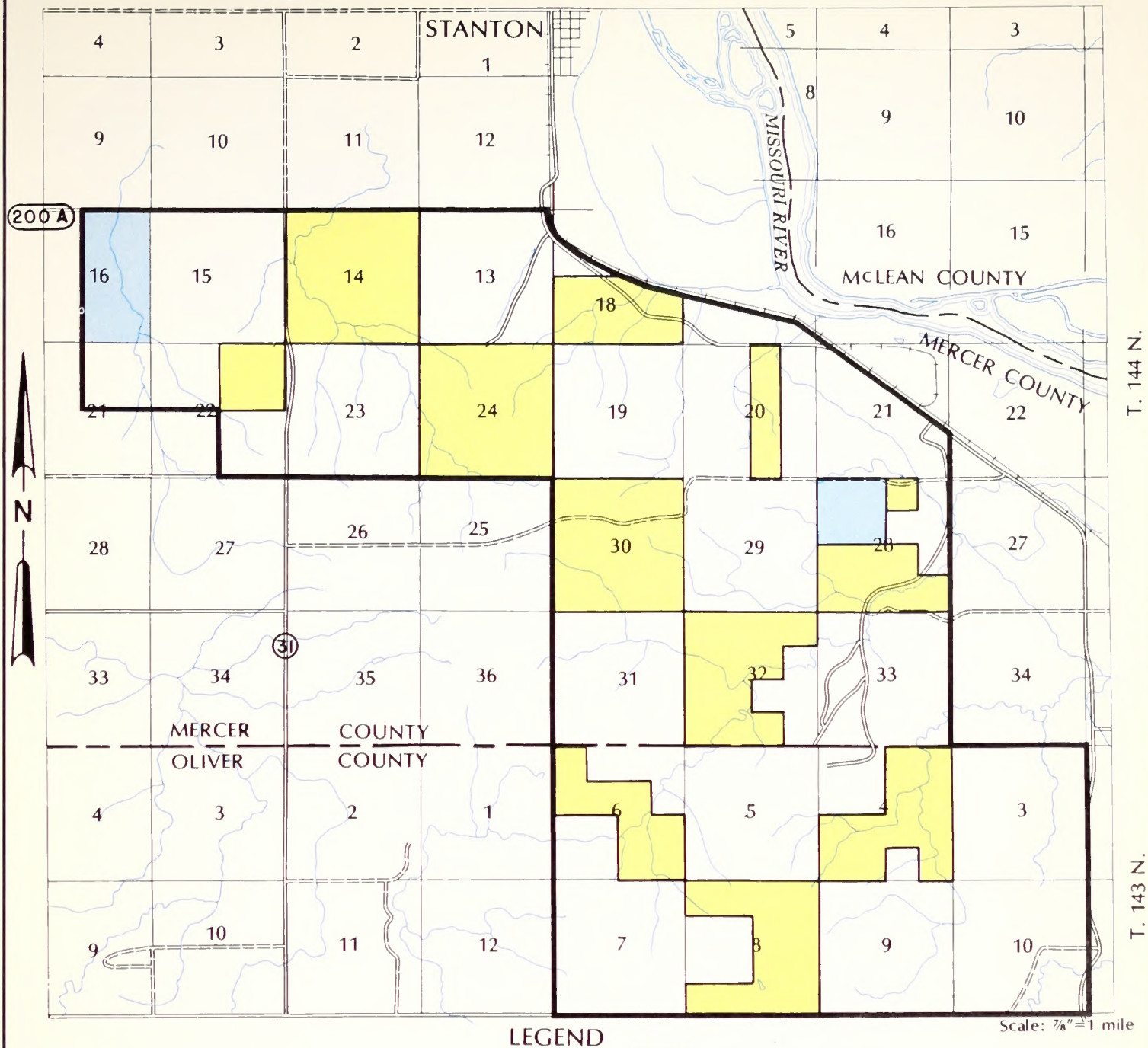
SOURCE: North Dakota Public Service Commission 1977



GLENHAROLD MINE PROJECT AREA

SOURCE: Consolidation Coal Company, 1979

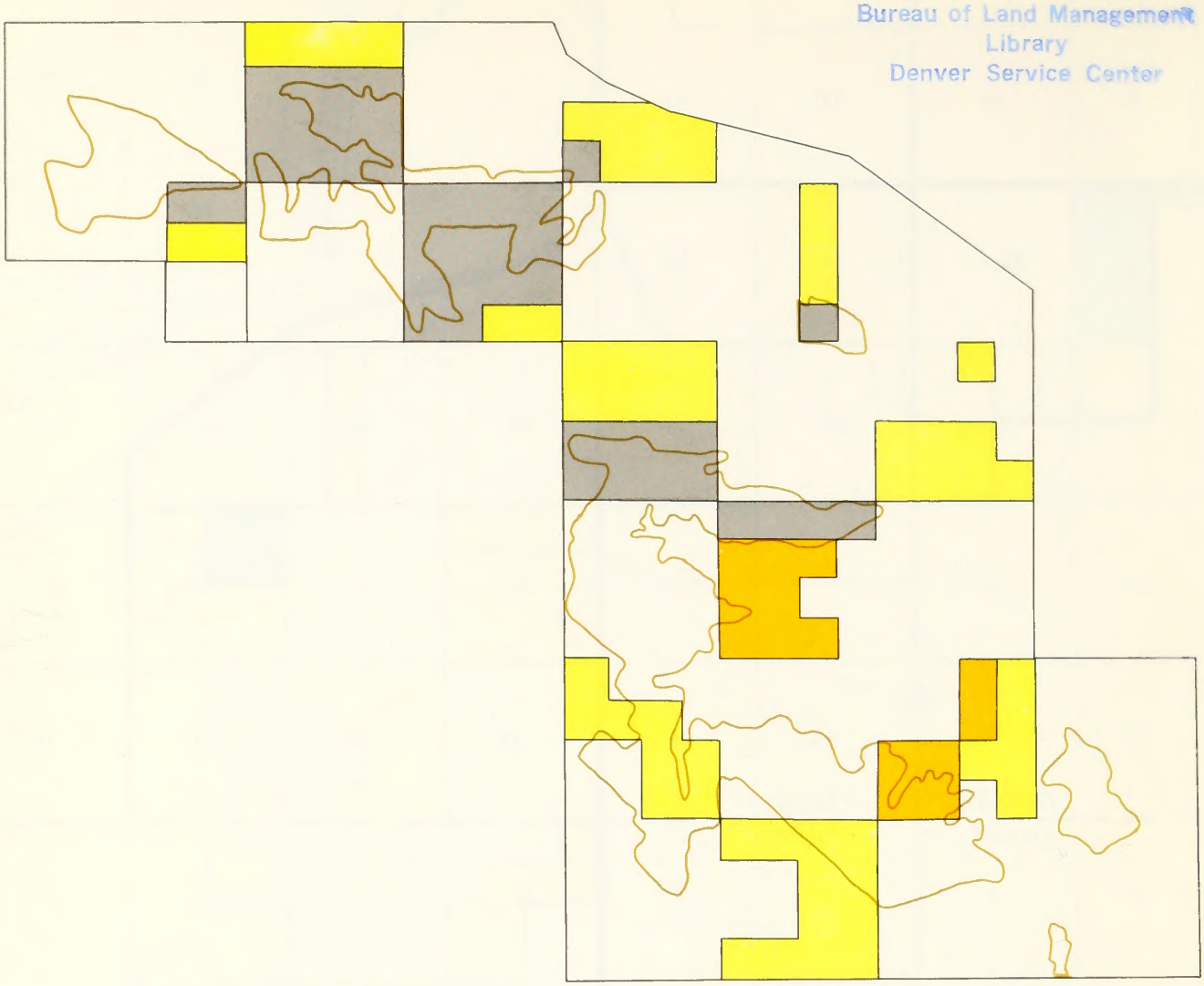
MAP 1-4



SOURCE: Larson 1977

Note: Based on Bureau of Land Management 1977 and North Dakota State Land Department 1977

FEDERAL AND STATE SUBSURFACE OWNERSHIP



LEGEND

- Federal Short Term Application Areas
- Existing Federal Leases to Consol
- Other Federal Coal
- Proposed Mining Boundary

SOURCE: BLM, 1979.

FEDERAL COAL STATUS

The federal government owns no surface rights within the Glenharold project area; however, it does hold scattered mineral ownership of approximately 4,550 acres within the project area. Consolidation Coal Company's existing federal coal leases, 560.77 acres, also are shown on the above overlay and Map 1-4.

Surface owner consent and unsuitability criteria are addressed in the Land Use Analysis Document under separate cover included in the folder.

Consolidation Coal Company's operating plan is used as part of the proposed action for analytical purposes to help determine the likely consequences of mining, but does not indicate a leasing preference on the part of the BLM. Should leasing occur and some bidder other than the applicant be awarded the lease, their plans would have to be assessed before mining plan approval.

The Glenharold Mine is owned and operated by the Truax-Tracer Coal Division of Consolidation Coal Company, a wholly owned subsidiary of the Continental Coal Company.

The company has applied for additional federal, state, county, and private coal leases and permits to allow the continued mining of approximately 3.7 million tons of lignite annually from the Glenharold Mine.

In the fall of 1965, the Glenharold Mine began supplying 1.3 million tons of coal per year under contract to a newly constructed 217 megawatt unit of the Basin Electric Power Cooperative's Leland Olds power plant. The mine production rate was increased to 3.7 million tons annually in May 1975 to supply an additional 438 megawatt generating unit (Figure 1-1). Electric power from the Leland Olds plant is distributed to over one million rural customers throughout the Midwest. Approximately 30% of Basin Electric's consumers are within North Dakota.

Consolidation Coal Company applied for the lease of approximately 1,200 acres of federal coal at the Glenharold Mine in 1972. In 1974, the Department of the Interior offered for competitive lease sale 320 acres or 27% of the area under the coal lease application. There were no bids for the 320 acre lease sale.

In January 1975, Consolidation Coal Company requested an immediate lease sale of 480 acres of the amended 1972 lease application. Because of changes in law, regulations, and policy, further action was not taken on the amended coal lease application of which the 480 acres were a part, until the Regional Environmental Impact Study on Energy Development in west central North Dakota and the Glenharold Site-Specific Environmental Impact Study were completed. In 1975, through an amendment request to the original lease application by the Consolidation Coal Company, the lands applied for increased to 2,032.44 acres.

The Glenharold Mine project area is composed of approximately 15,223 acres as shown on Map 1-3. This project area includes the existing mine, road system, support facilities, and areas already mined.

Within the project area, Consolidation Coal Company holds eight current permits for mining and associated reclamation from the Public Service Commission. Lands under active mining permits from the state are shown on Map 1-2.

Within the 15,223 acre project area, an estimated 26.4 million tons of coal have been mined since late 1965. Approximately 4% of the mined coal came from two existing federal coal leases. Additional recoverable federal reserves calculated at about 17.8 million tons underlie about 983 surface acres in the short-term lease application (Table 1-1).

Leased federal subsurface acreage, federal short-term lease application acreage, and remaining unleased federal coal reserves within the project area are shown in Table 1-2. Additional federal subsurface with coal reserves exist outside the project boundary and have been addressed in the West Central North Dakota Regional Environmental Impact Study on Energy Development under "Federal Coal Study Areas."

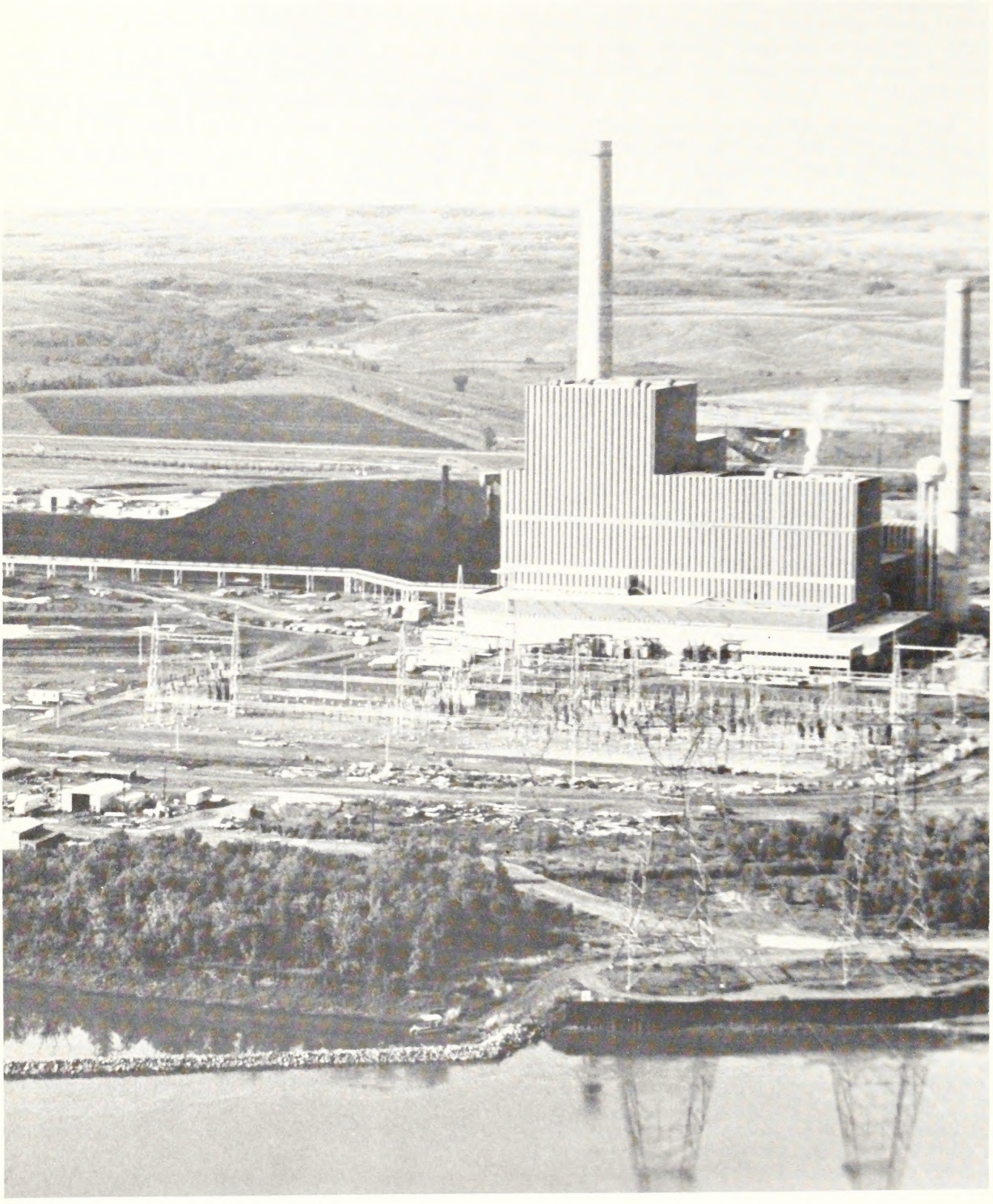
MINE OPERATIONS

The following preliminary mining operations plan reflects state and federal regulations. Map 1-5 shows a typical mining sequence in the project area. It is likely that the mining sequence would be adjusted somewhat when the mining plan is approved if the federal coal in the short-term application area is leased.

Operations at Glenharold basically entail exploration, mining, and reclamation stages. These stages consist of several discrete steps which, though described separately, may occur simultaneously. Because the Glenharold Mine has been in operation since 1965, most roads and ancillary facilities are already in place. Additional ancillary facilities are not anticipated.

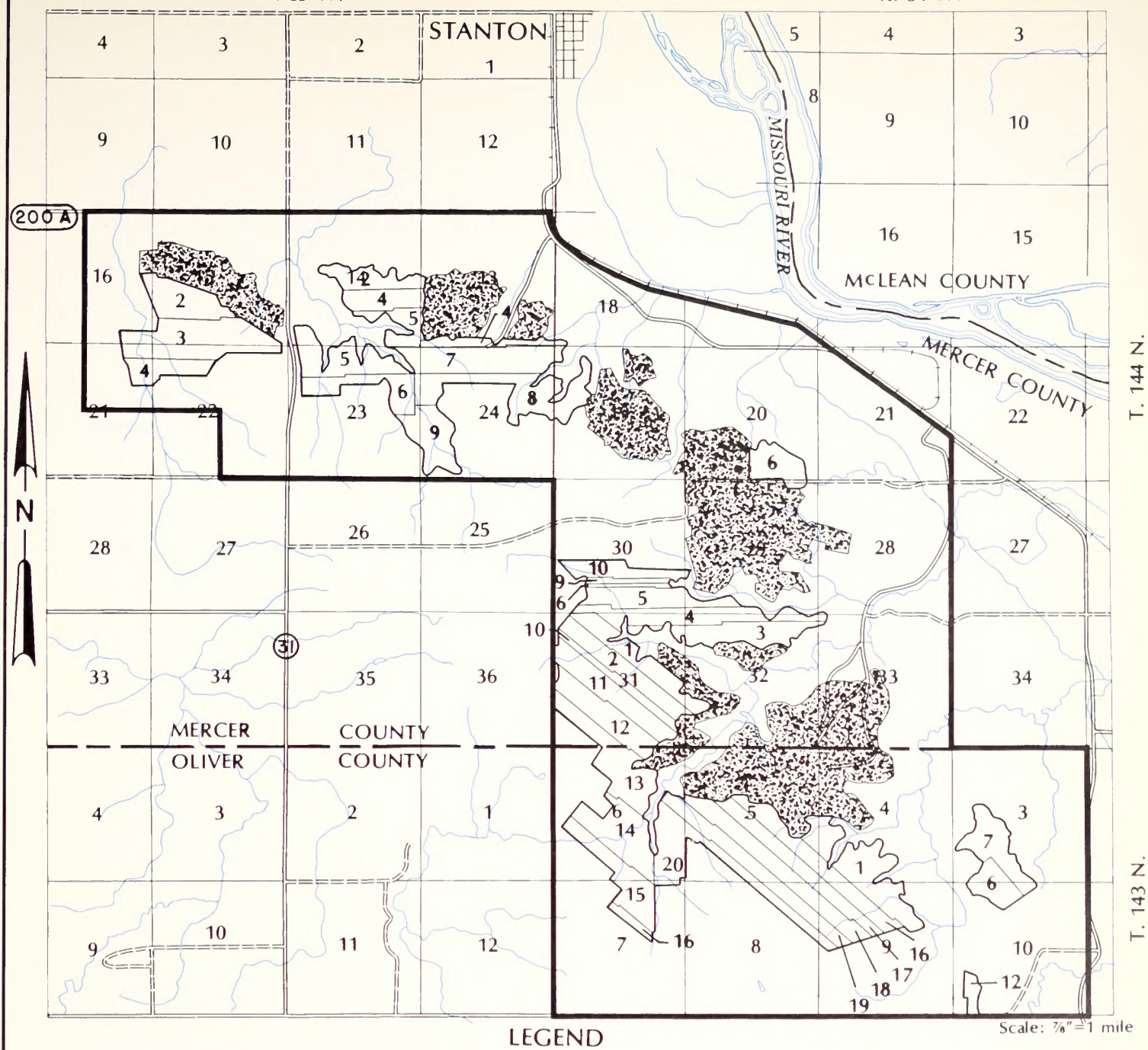
Exploration would be done by drilling and geophysical logging of drill holes. Drilling would be done on a 330-foot grid except for outcrop areas where closer drilling is necessary to locate the

Figure 1-1



Leland Olds Power Plant at Stanton, North Dakota

SOURCE: Bureau of Land Management 1977



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Proposed Mining Boundary

NOTE: Numbers refer to mining sequence.

SOURCE: Consolidation Coal Company, 1978.

TYPICAL MINE SEQUENCE — GLENHAROLD MINE

TABLE 1-1

PROJECT AND FEDERAL LEASE APPLICATION ACREAGES

	Total Acres	Remaining Minable Acres	Federal Short-Term Lease Application	
			Total Acres	Minable Acres
Project Boundary	15,223	3,547	1,668	983

NOTE: Approximately 1,978 surface acres have been mined.

SOURCE: Bureau of Land Management 1979.

TABLE 1-2

PROJECT AREA AND FEDERAL SUBSURFACE RELATIONSHIPS

		Federal Coal		
	Project Boundary	Short-Term Lease Apln.	Existing Lease	Remaining Unleased
Total Surface Acres	15,223	1,668	561	2,321
% of Project Boundary	100%	11%	3.7%	15%
Mined Surface	1,978	None	160	None
% of Project Boundary	100%	0	8.0%	0
Likely Remaining Minable Surface Acres	3,547	983	111	291
% of Project Boundary	100%	28%	3.0%	8%

SOURCE: Bureau of Land Management 1979.

edges of the coal beds. After logging, drill cuttings would be returned to the drill hole which would be capped with a cement plug to avoid open holes. With the exception of drilling to define outcrops, where topography is too irregular for a drilling setup, alternate drilling sites would be chosen. For outcrop definition drilling, heavy equipment would be used to build level drilling sites. Core samples would be taken at alternate drill sites and overburden samples would be taken for each 40-acre area.

The Glenharold Mine is a multiple coal bed operation with up to four minable coal seams (Figure 1-2 and Figure 1-3). The lower-most bed identified as the Stanton bed ranges between 7 and 12 feet thick and is being mined to an average depth of 110 feet. The overlaying coal seams range from two to six feet in thickness. These are being recovered where individual bed thickness is three feet or more and where seams divide if the separation between the split seams is less than two feet thick. Where the Stanton bed is overlain by more than 110 feet of overburden and is not being mined, the overlaying coal beds are also not being mined.

Mining operations commence following mapping and classification of the area by a state registered soils classifier (Figure 1-4). The soils are removed in two operations (lifts). Lift one is the removal of topsoil by scrapers and dozers. The topsoil is either stockpiled in a specified area for later use during reclamation, or spread on replaced subsoil in an active reclamation area. The second lift is removal of the subsoil. The subsoil either is placed directly on reshaped spoil piles or is stockpiled separately from the topsoil. Erosion of the stockpiles is inhibited by seeding and positioning of the piles. The seeding composition must be approved by the Bureau of Land Management District Manager and the North Dakota Public Service Commission.

The remaining overburden (all materials between the subsoil and the coal beds) is removed with an electrically powered 60 or 34 cubic yard dragline (Figure 1-5). The company currently has two machines operating in separate pits. The 60-yard dragline is capable of removing overburden to a depth of 100 feet, the 34-yard dragline can remove overburden to a depth of 70 feet. Initially, overburden is piled adjacent to the first cut excavated. Overburden from each succeeding cut is placed in the immediately preceding trench. A bulldozer or front-end loader removes the loose clay from the top of the coal seam. Lower coal beds are uncovered by the dragline unless the interburden (material between the coal seams) is less than eight feet thick, in which case heavy equipment is used. With the exception of holidays, stripping continues 24 hours a day, 7 days a week.

Surface water quality will be monitored where necessary to meet effluent limitations and maintain downstream water quality, sediment control measures will be used, and surface drainage will pass through a sedimentation pond or series of sedimentation ponds (30 CFR part 816.42).

Where necessary to minimize erosion and to prevent surface water from contacting toxic-producing deposits, overland flow will be diverted away from disturbed areas with temporary or permanent diversion structures (30 CFR part 816.43).

Stream channel diversions, sediment control measures, and sedimentation ponds will be located and constructed in accordance with 30 CFR parts 816.44, 816.45, and 816.46.

Discharges from sedimentation ponds and diversion will be controlled where necessary to reduce erosion and stream channel cutting and to minimize disturbances to the hydrologic system (30 CFR part 816.47).

Ground water levels, infiltration rates, subsurface flow and storage characteristics, and the quality of ground water shall be monitored in a manner approved by the regulatory authority to determine the effects of mining activity on the recharge capacity of reclaimed lands and on the quality and quantity of water in ground water systems in the mine plan and adjacent areas.

After the overburden is removed, the exposed coal seam is drilled and then blasted using an ammonium nitrate and oil mixture to fracture the coal. Blasting is usually done twice a day (11:00 a.m. and 2:30 p.m.), five days a week. Two 15 cubic yard electric shovels (Figure 1-6) excavate the coal and load it into 180 ton, diesel/electrical powered coal haulers. A 10 cubic yard front-end loader is used if space is limited. Loading is done in two shifts per day, five days per week.

The coal is transported from the pit, up a 7% grade ramp road, on unpaved haul roads to the coal preparation facilities (tipple). Haul roads are graded, 80 feet wide, and flanked by ditches 5 feet wide and 2 feet deep. At the preparation facilities, the coal is dumped, crushed to less than three-quarter inch size, and sent on a conveyor belt to the power plant or to a stockpile for future processing.

During reclamation, the overburden piles are reshaped. This includes the last cut, which normally has little overburden put back into it. The high wall is cut back and graded to blend with the adjacent terrain. Large bulldozers and scrapers are normally used. Reshaping is usually done two or three spoil piles behind the mining operation, depending on weather and working conditions. An annual average

Figure 1-2

Multiple Coal Beds in Side Cut

SOURCE: Bureau of Land Management 1977

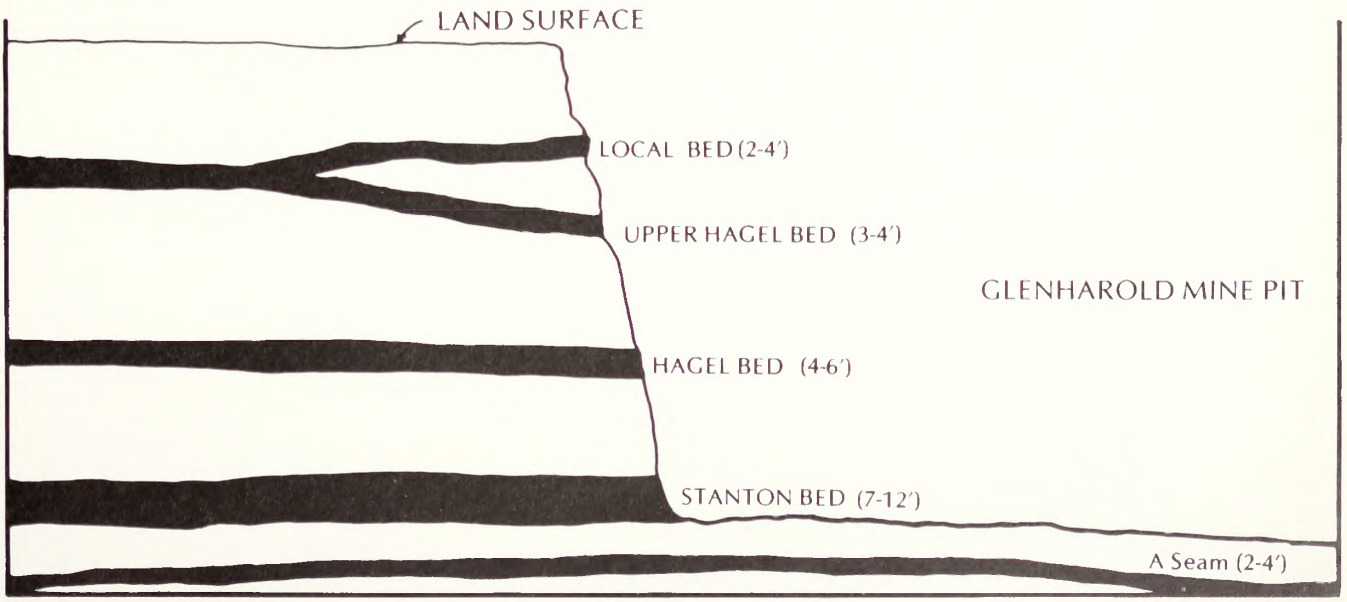


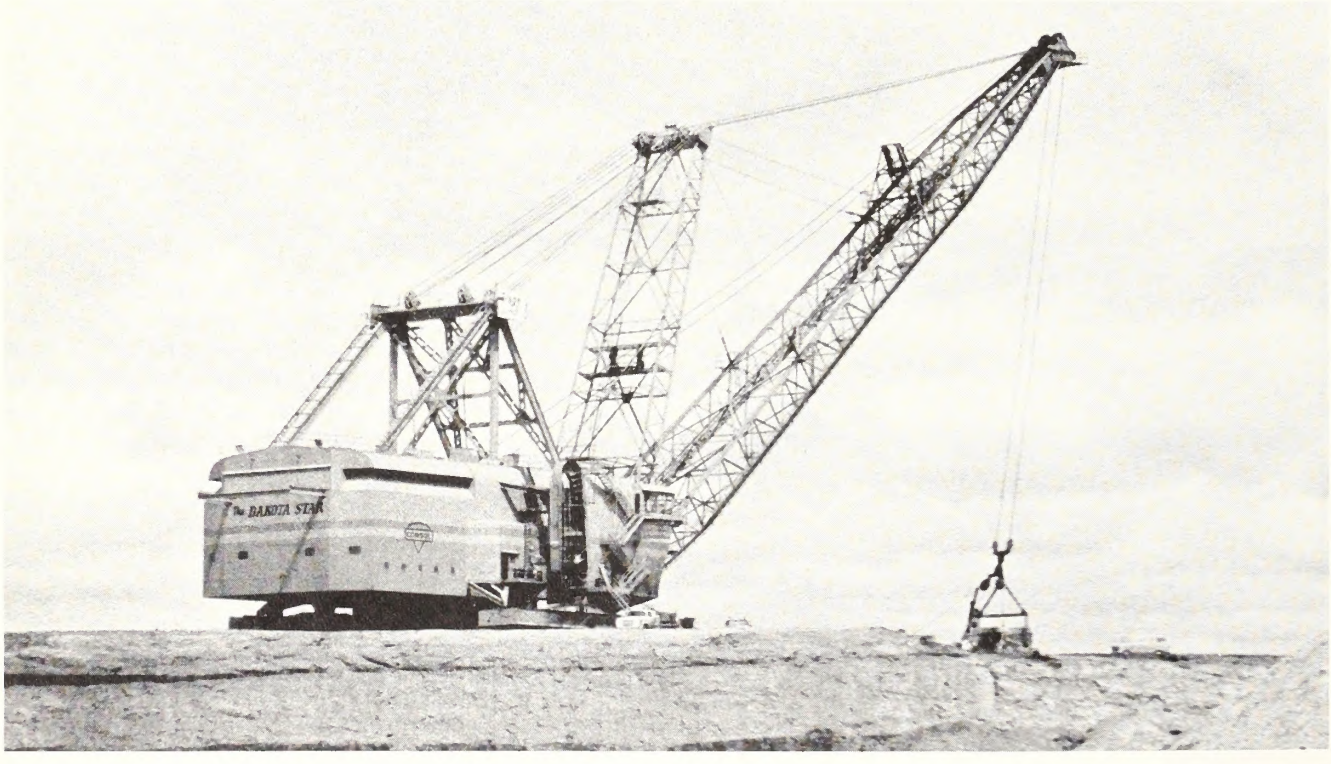
Figure 1-3 SCHEMATIC COAL PROFILE - GLENHAROLD MINE

SOURCE: Kesterke 1977.

Figure 1-4

Topsoil Benchmark at Glenharold Mine

SOURCE: Bureau of Land Management 1977



Electrically Powered 60-Cubic-Yard Dragline at the Glenharold Mine

Figure 1-5

SOURCE: Bureau of Land Management 1977

Figure 1-6

Coal Hauler Being Loaded by a 15-Cubic-Yard Electric Shovel

SOURCE: Bureau of Land Management 1977

Typical Regraded and Seeded Area

Figure 1-7

SOURCE: Bureau of Land Management 1977

of 155 acres per year would be mined with an estimated total of 211 acres disturbed. Reshaping includes the grading of spoils to approximate the original topography and to establish surface drainage patterns consistent with the surrounding area. Slope gradients and drainage would be in accordance with state (North Dakota Century Code 38-14) or 30 CFR parts 816.101, 102, whichever is more stringent.

Total disturbed acreage includes mined land and assumes an additional 36% disturbance with soil stockpiles, haul roads, and equipment storage. With a five year period between initial mining and accomplishment of reclamation, the total area disturbed at any one time is approximately 1,055 acres.

Subsoil is spread on the graded overburden. Topsoil is then spread over the subsoil by large wheeled tractor-scrapers during seasons when the ground is not frozen.

The seeding operation involves site preparation (such as contour plowing) and seeding with appropriate vegetation. This may include the use of a bulldozer, but is normally limited to farm tractors and implements. Figure 1-7 shows a typical regraded and seeded area.

The BLM has determined that the post-mining land use within the short-term application area will be the same as pre-mining use. Tables 1-3 and 1-4 give recommended seeding and planting mixtures which would accomplish post-mining land use goals for native vegetation.

The present Glenharold Mine work force includes 115 union employees and 41 salaried personnel. The annual payroll (1976) is $2,940,000. Most mine employees live in Hazen, Stanton, or Washburn.

The Glenharold Mine is serviced by the Burlington Northern Railroad. A short spur line provides access to the mine property for freight delivery. Very little coal is shipped by rail, although limited facilities exist for rail loading.

A 69 kilovolt power line serves the mine and is considered adequate for present and future needs. The mine uses 2.85 million kilowatt hours per month.

All company vehicles are fitted with manufacturers' current pollution control devices and are maintained to satisfy federal anti-pollution requirements.

Primary water usage is for dust suppression on haul roads, and use in the tipple, tipple washdown, boiler make-up water, bathhouse, shop, and office. Water used for haul roads comes from a well 45 feet deep, 300 yards east of the mine office. Forty thousand gallons are applied daily on dry days (about 120 days per year). The tipple uses 30,000 gallons per day, 230 days per year. Bathhouse, shop, and office usage amounts to 2,500 gallons per day, 230 days per year. Water for the tipple, bathhouse, shop, and office is provided by Basin Electric Power Cooperative. Total annual usage is 12.276 million gallons.

Haul roads are scoria covered to stablilize their surfaces. A chemical dust inhibitor is applied to dust sources in the processing equipment (tipple). Use of the spray is discontinued at temperatures below -10 degrees Fahrenheit due to icing problems.

GOVERNMENTAL AUTHORITIES AND PROCEDURES

The governmental authorities and procedures are detailed in the West Central North Dakota Regional Environmental Impact Study on Energy Development, pages 20 and 21. In brief, actions that must be taken by governmental agencies if mining is to take place include: leasing and exploration permits for federal coal (Bureau of Land Management); approval of mining plans involving federal coal (Office of Surface Mining Reclamation and Enforcement in consultation with the Geological Survey and the Bureau of Land Management); permits to engage in surface mining (North Dakota Public Service Commission); waste disposal (North Dakota Health Department); ancillary facilities (other state agencies); and conditional use permits from Mercer and Oliver Counties for mining and excavation.

RELATIONSHIP WITH OTHER PROJECTS

The Glenharold Mine provides all the fuel for the Leland Olds Power Plant (Tables 1-5 and 1-6). Through this relationship, it is indirectly associated with the other existing and proposed projects in the area (Map 1-6). The Leland Olds plant accounts for 25.3% of the power production in the area. The plant burns an average of 3,700,000 tons of lignite annually and maintains a stockpile of 80,000 tons.

TABLE 1-3

RECOMMENDED GRASS, FORB, AND SHRUB SEEDING MIXTURES

Species[1/]	Ratio of Seeding[2/] (pounds)
Western wheatgrass (Agropyron smithii)	3 to 8 PLS/acre
Green needlegrass (Stipa viridula)	3 to 8 PLS/acre
Needle-and-thread (Stipa comata)	3 to 6 PLS/acre
Blue grama (Bouteloua gracilis)	3 to 6 PLS/acre
Little bluestem (Andropogon scoparius)	2 to 6 PLS/acre
Big bluestem (Andropogon gerardi)	2 to 6 PLS/acre
Indiangrass (Sorghastrum nutons)	2 to 6 PLS/acre
Switchgrass (Panicum virgatum)	2 to 6 PLS/acre
Prairie junegrass (Koeleria crisata)	3 to 6 PLS/acre
Inland saltgrass (Distichlis stricta)	4 to 8 PLS/acre
Northern reedgrass (Calamagrostis inexpansa)	2 to 3 PLS/acre
Buckbrush (Symphoricarpos occidentalis)	0.5 to 4 PLS/acre
Snowberry (Symphoricarpos albus)	0.5 to 4 PLS/acre
Silverberry (Elaeagnus argentea)	0.5 to 4 PLS/acre
Western wildrose (Rosa woodsii)	0.5 to 4 PLS/acre
Currants (Ribes spp.)	0.5 to 4 PLS/acre
Fringed sage (Artemisia fridiga)	0.5 to 4 PLS/acre
Siver sage (Artemisia cana)	0.5 to 4 PLS/acre
Skunkbush (Rhus aromatica)	0.5 to 4 PLS/acre
Buffaloberry (Shepherdia argentea)	0.5 to 4 PLS/acre
Hawthorn (Crataegus rotundifolia)	0.5 to 4 PLS/acre
Chokecherry (Prunus virginiana)	0.5 to 4 PLS/acre
Wild plum (Prunus americana)	0.5 to 4 PLS/acre
Native willow (Salix spp.)	0.5 to 4 PLS/acre
Yellow sweet clover (Melilotus officinalis)	0.5 to 2 PLS/acre
Other native forbs (individual species)	0.5 to 2 PLS/acre

1/ Additional species may be added for special areas or as designated in the approved reclamation plan. All grassland and shrubland will be selected from the above list or additional species and planted at a minimum rate of 18 to 20 pounds PLS/acre. Yellow sweet clover and other native forbs will be used in all grassland and shrubland seeding mixtures as specified and designated in the approved reclamation plan.

2/ Ratios may be adjusted for special areas as designated in the approved reclamation plan.

SOURCE: Bureau of Land Management 1979

TABLE 1-4

RECOMMENDED SHRUB AND TREE PLANTINGS

Species[1/]	Pots/Acre	Bare-root Stock Stems/Acre
Buckbrush (*Symphoricarpos occidentalis*)	200	300
Snowberry (*Symphoricarpos albus*)	200	300
Silverberry (*Elaeagnus argentea*)	200	300
Western wild rose (*Rosa woodsii*)	200	300
Currants (*Ribes spp.*)	200	300
Fringed sage (*Artemisia fridiga*	200	300
Silver sage (*Artemisia cara*)	200	300
Skunkbush (*Rhus aromatica*)	150	300
Buffaloberry (*Shepherdia argentea*)	150	300
Hawthorn (*Crataegus rotundifolia*)	150	300
Chokecherry (*Prunus virginiana*)	150	300
Native plum (*Prunus americana*)	150	300
Native cottonwood (*Populus deltoides*)	100	300
Native willow (*Salix spp.*)	100	300
Green ash (*Fraxinus pennsylvanica*)	100	300
Bur oak (*Quercus macrocarpa*)	100	300
Rocky Mountain juniper (*Juniperus scopulurum*)	100	300
Boxelder (*Acer negundo*)	100	300

1/ Additional species may be added for special areas or as designated in the approved reclamation plan. All shrub and/or tree planting mixtures will be selected from the above list or added species and planted at rates of 2,000 potted or 4,000 bare-root stock/acre at a ratio of 2 shrubs to 1 tree, unless otherwise designated for special areas in the approved mining plan.

SOURCE: Bureau of Land Management 1979

TABLE 1-5

EXISTING COAL MINES IN WEST CENTRAL NORTH DAKOTA

Company Coal User in ()	County	Coal Production (million tons/yr)	Surface Disturbance (acres/yr)	Type	Peak Labor Force (no change after 1981) 1977	1978	1979	1980	1981
CONSOLIDATION Glenharold Mine (Leland Olds Station)	Mercer	3.7	211	Perm.	156	156	156	156	156
BAUKOL-NOONAN Center Mine (Milton R. Young Station)	Oliver	4.4	184	Perm.	80	80	80	80	80
FALKIRK Falkirk Mine (Coal Creek Station)	McLean	5.6	314	Const. Perm.	100 130	180 180	100 230	50 285	-- 300
HUSKY INDUSTRIES Husky Mine (Husky Industries)	Stark	0.1	12	Perm.	15	15	15	15	15
KNIFE RIVER Beulah Mine (Beulah Station, Heskett Station, Ottertail Power, MN)	Mercer	1.2	82	Perm.	72	72	72	72	72
NORTH AMERICAN Indianhead Mine (Stanton Generating Plant)	Mercer	1.1	91	Perm.	70	70	70	70	70
TOTAL		15.9	894	Const. Perm.	100 523	180 573	100 623	50 679	-- 693

SOURCE: Compiled from information supplied by Consolidation Coal Company; Baukol-Noonan, Inc.; Falkirk Mining Company; Husky Industries; Knife River Coal Mining Company; and North American Coal Corporation 1976 and 1977.

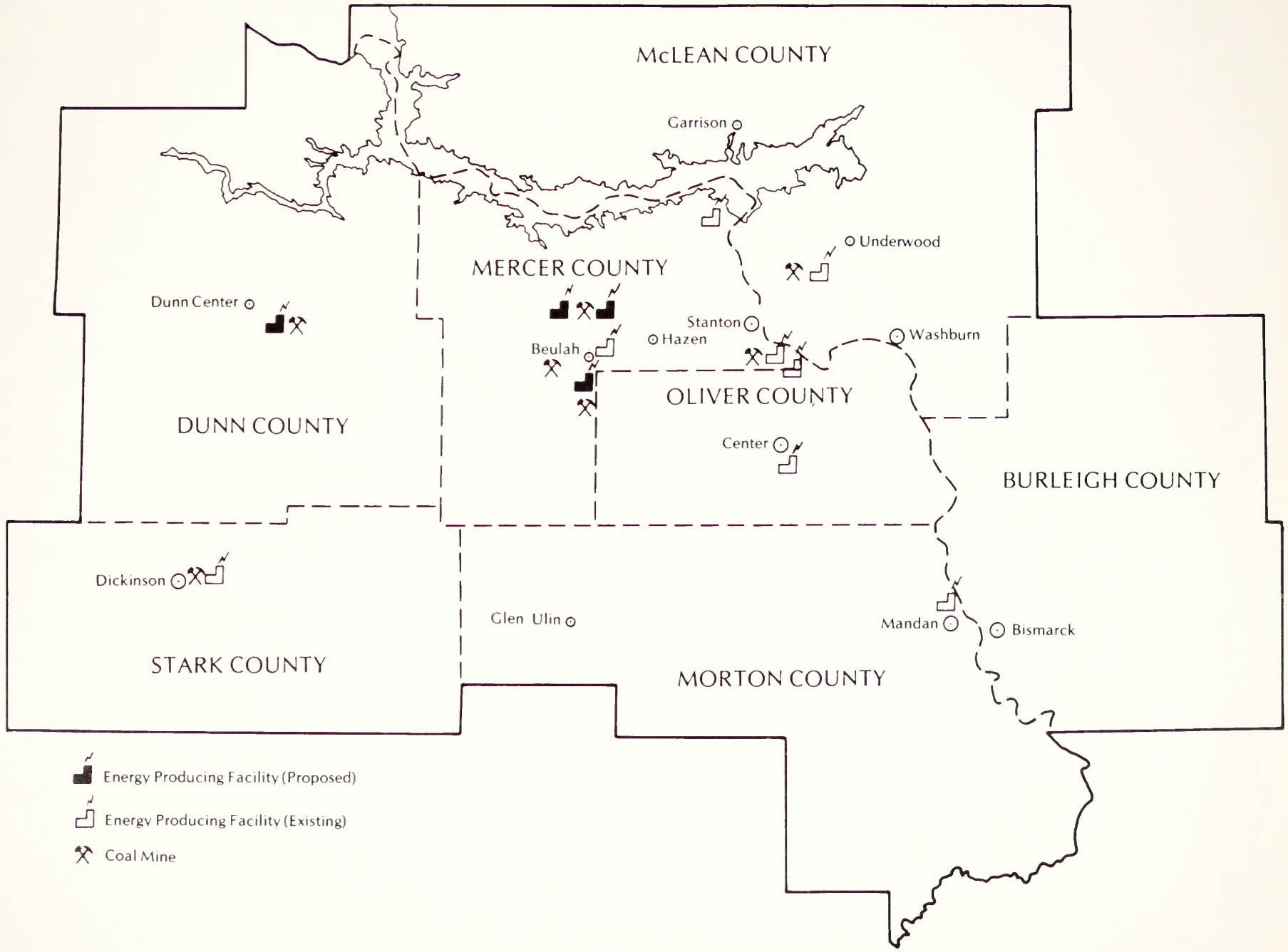
TABLE 1-6

EXISTING ENERGY CONVERSION FACILITIES IN WEST CENTRAL NORTH DAKOTA

Company/Agency Coal Source in ()	County	Design Capacity (megawatts)	Average Coal Consumption (million tons/yr)	Average Water Consumption (acre-feet/yr)	Peak Labor Force (no change after 1980) Type	1977	1978	1979	1980
BASIN ELECTRIC Leland Olds Station Units 1 and 2 (Glenharold Mine)	Mercer	655MW	3.7	486	Perm.	88	88	88	88
MINNKOTA Milton R. Young Station Units 1 and 2 (Center Mine)	Oliver	682MW	4.4	1,040	Perm.	100	100	100	100
MONTANA-DAKOTA UTILITIES Beulah Station (Beulah Mine)	Mercer	13.5MW	0.1	1,190	Perm.	25	25	25	25
Heskett Station (Beulah Mine)	Morton	100MW	0.5	67	Perm.	46	46	46	46
UNITED POWER ASSOCIATION Station Generating Plant (Indianhead Mine)	Mercer	172MW	0.9	256	Perm.	51	51	51	51
UNITED POWER ASSOCIATION-COOPERATIVE POWER ASSN. Coal Creek Station Units 1 and 2 (Falkirk Mine)	McLean	1,000MW	5.6	13,000	Const. Perm.	825 60	800 110	450 163	-- 163
CORPS OF ENGINEERS Garrison Hydroelectric Station	McLean-Mercer	400MW	--	--	Perm.	34	34	34	34
TOTAL		3,022.5MW	15.2	16,029	Const. Perm.	825 404	800 454	450 507	-- 507

SOURCE: Compiled from information supplied by Basin Electric Power Cooperative; Minnkota Power Cooperative, Inc.; Montana-Dakota Utilities Company; United Power Association; Cooperative Power Association; U.S. Corps of Engineers 1976 and 1977

MAP 1-6



PROPOSED AND EXISTING ENERGY FACILITIES AND MINES

SOURCE: BLM, 1977

The Leland Olds plant is connected by transmission lines to the Bureau of Reclamation power grid, the Garrison hydroelectric plant, and United Power Association's Stanton generating plant. Also connected to the Bureau of Reclamation grid is Montana-Dakota Utilities Company's R.M. Heskett plant. Montana-Dakota Utilities' Beulah plant is also connected to the Garrison plant, as well as to Heskett, and by transmission lines to Dickinson, North Dakota. United Power Association's Stanton plant also connects to Minnkota Power Cooperative's Milton R. Young and United Power Association/ Cooperative Power Association's Coal Creek Station. Coal Creek is under construction and scheduled for completion in 1978-1979.

Chapter II

Description of the Environment

CLIMATE AND AIR QUALITY

Project Area

The project area is characterized by light to moderate precipitation (which tends to be irregular in time and distribution), low relative humidity, and nearly continuous air movement. The cold, dry air masses from the north intensify this area's winters; the warm, relatively moist air from the south dictates most of the area's precipitation characterstics.

As no long-standing wind records exist in the Stanton area, the records of four nearby National Weather Service stations were used to evaluate wind behavior in the Stanton area. Table 2-1 compares the surface wind climatological features of these four stations. The wind roses for these four stations are shown in Figure 2-1.

The differences in surface wind climatology among the four stations may be seen from Table 2-1. The lower annual mean wind speed at Williston, 8.2 knots (9.4 miles per hour), as opposed to the 11.9 knots (13.7 miles per hour) annual mean wind speed at Dickinson, is the most notable of the minor differences. Williston has lower wind speeds and lower frequency of northwesterly winds than the other more easterly stations. There is generally good agreement of the surface wind data among the four stations as shown in Figure 2-1. Northwesterly winds prevail during fall and winter (September through March). In the spring and summer, southeasterly winds prevail. Winter cold fronts and low pressure systems can produce winds of about the same speed as those associated with summer thunderstorms. High winds in winter can be sustained over a period of several hours, and in rare cases two to three days. In the summer, the duration of strong winds is usually on the order of a few minutes.

The nearest station with long-term climatic data is at Center, 10 miles south of the Glenharold Mine. A climograph of average monthly temperature and precipitation at Center is presented in Figure 2-2. This figure was compiled from National Weather Service records from 1959 to 1976 for temperature and 1941 to 1970 for precipitation. These records are good indicators of the temperature and precipitation at the Glenharold Mine. The minimum average temperature of 9 degrees F. occurs in January, with a maximum average of near 70 degrees F. occurring in July. The minimum precipitation average of near 0.5 inch occurs during December. The maximum average precipitation of 3.55 inches occurs during June. Precipitation for the year at Center averages 17.8 inches.

Emissions

Air sampling stations have been established throughout North Dakota and are operated by the State Department of Health. Map 2-1 shows the spatial distribution, by type, of the air sampling stations in western North Dakota. Four stations are located near the Glenharold Mine. Air quality parameters examined at each site are listed in Table 2-2. The Stanton rural site is the best indicator of air quality in the Stanton vicinity. Data for 1976 is summarized in Table 2-3 for all four stations.

The State of North Dakota Ambient Air Quality Standards, summarized in Table 2-4, provide for interpretation of relative air quality in the short term as well as in the long term. Long-term standards specify an annual mean value that may not be exceeded. Short-term standards specify upper limit values for 1-hour or 24-hour averages that may not be exceeded more than once per year or portion of a year.

Comparing the 1976 air quality data from the Beulah (urban and rural), Stanton, and Washburn sites with the applicable standard shows relatively good air quality throughout this area. The greatest air contaminant concentration is particulates, which includes windblown (fugitive) dust. The maximum allowable suspended particulate concentration was reached at the Stanton rural station once during 1976.

Suspended particulates in relatively high concentrations, common to the western states and occurring primarily as windblown dust, are shown in Table 2-5 for source emission contributions from point and area sources in Mercer and Oliver Counties. The projected emissions are expected under typical conditions. Temporary factors, such as atypical weather, could alter these projections; extended wet periods would tend to reduce total area-wide emissions, and extended dry periods would increase emissions.

TABLE 2-1

COMPARISON OF SURFACE WIND CLIMATOLOGICAL FEATURES BETWEEN
FOUR NATIONAL WEATHER SERVICE SURFACE WIND STATIONS

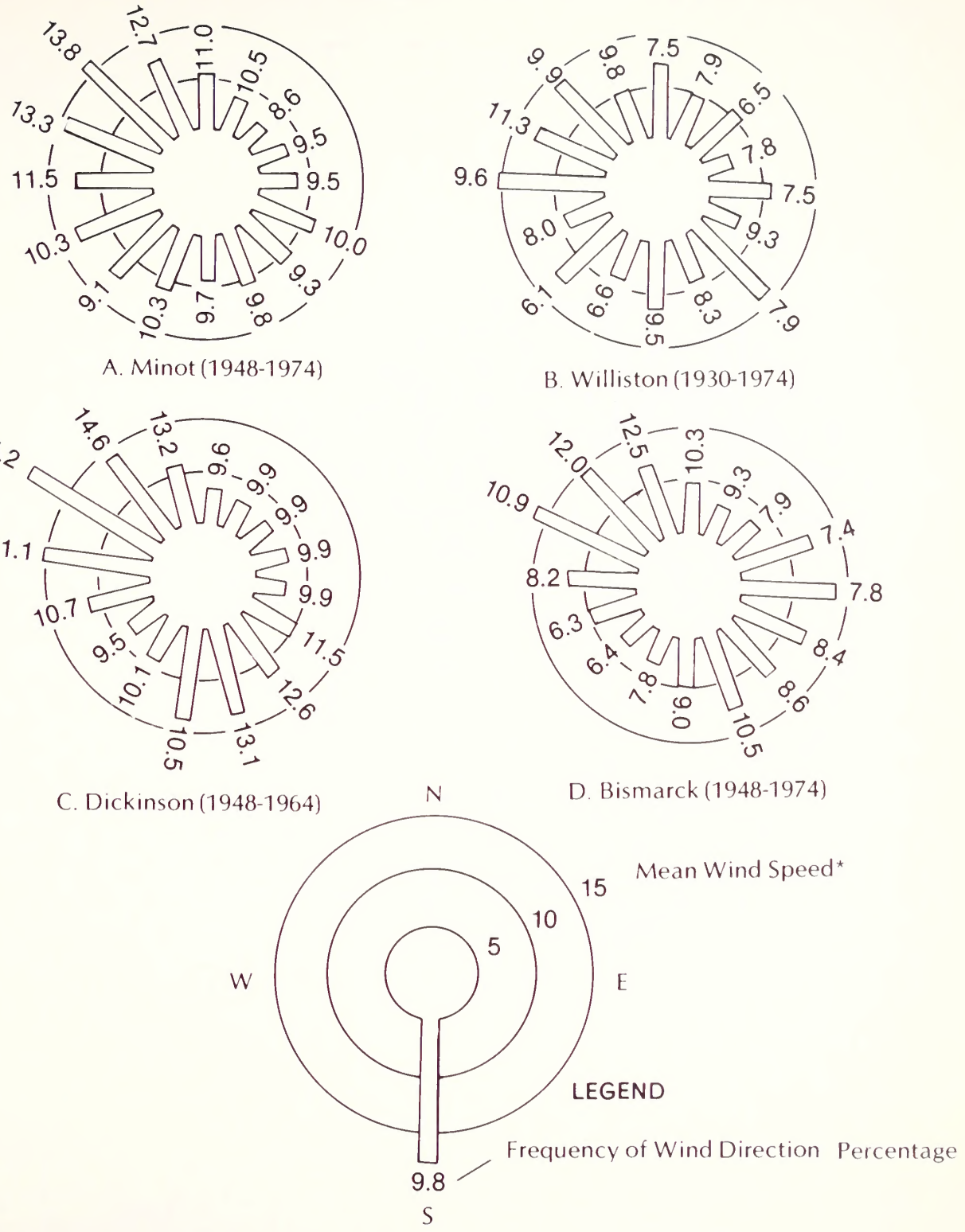
Feature	(1948-1974) Bismarck	(1948-1964) Dickinson	(1948-1974) Minot	(1950-1974) Williston
Annual Mean Wind Speed[1/] (MWS)	9.4	11.9	11.0	8.2
Highest Monthly MWS	11.1-April	13.0-April	12.1-April	9.6-April
Lowest Monthly MWS	8.5-July	10.4-July	9.6-July	7.3-Dec.
Prevailing Annual Wind Direction[2/]	11.2%-WNW	14.4%-WNW	11.2%-NW	10.5%-W
Least Prevalent Annual Wind Direction	3.2%-NNE	3.0%-NNE	2.7%-NE	2.4%-ENE
Prevailing Wind Direction in January	13.1%-WNW	18.4%-WNW	13.4%-WNW	12.0%-W
Least Prevalent Wind Direction in Jan.	2.3%-SSW	1.7%-NNE	2.0%-NE	2.0%-ENE
Prevailing Wind Direction in July	9.7%-SSE	10.7%-SE	9.5%-NW	10.7%-SE
Least Prevalent Wind Direction in July	2.9%-SW	2.9%-ENE	3.9%-ENE	2.9%-ENE

1/ Wind speed in knots (1 knot equals 1.152 miles per hour)

2/ Percent of time in month when given wind direction was observed.

SOURCE: Ramirez and Method 1976

Figure 2-1

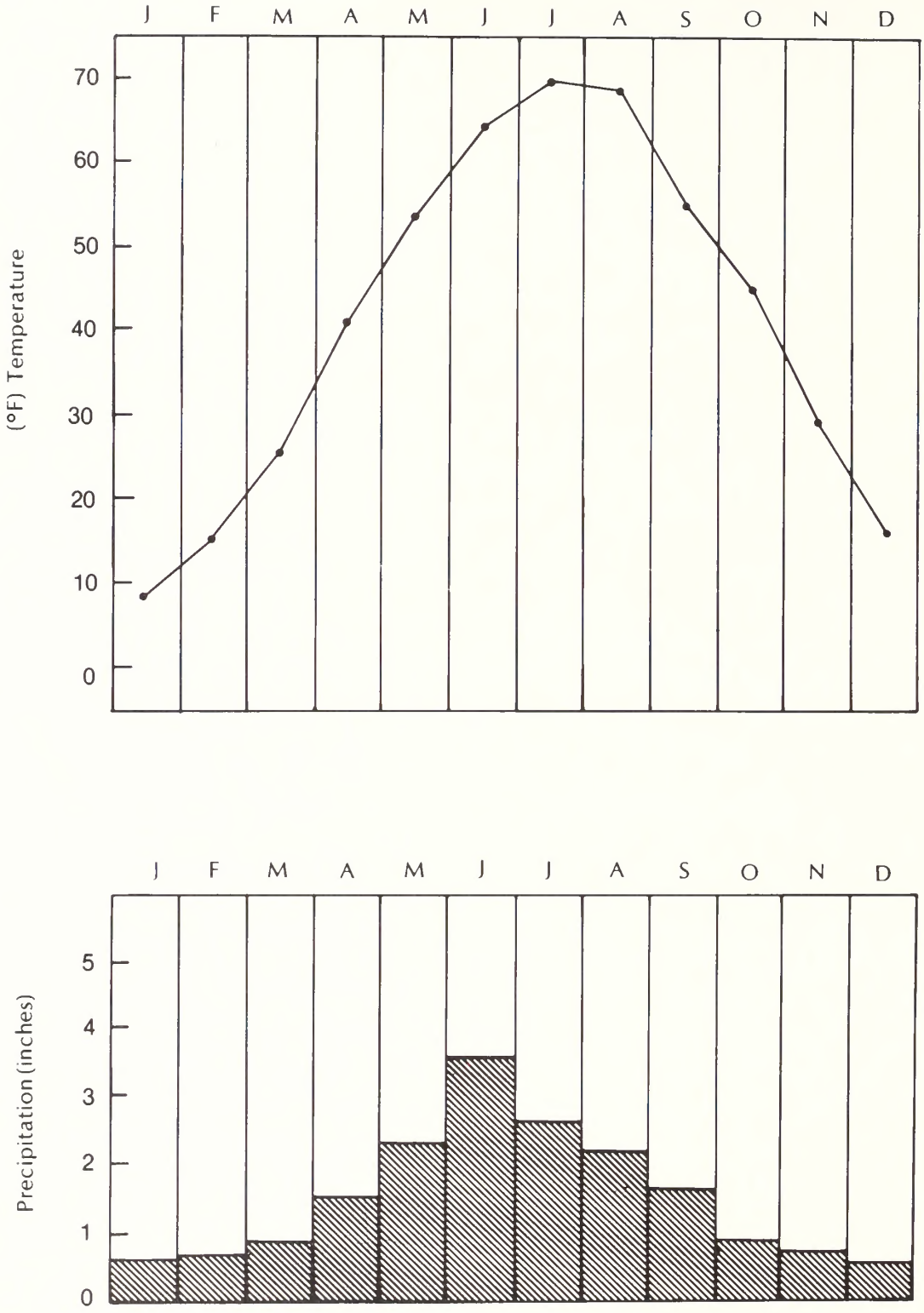


*Wind Speed in Knots 1 knot = 1.152 miles per hour

WIND ROSES FOR FOUR SELECTED NATIONAL WEATHER SERVICE STATIONS

SOURCE: Ramirez and Method 1976.

Figure 2-2



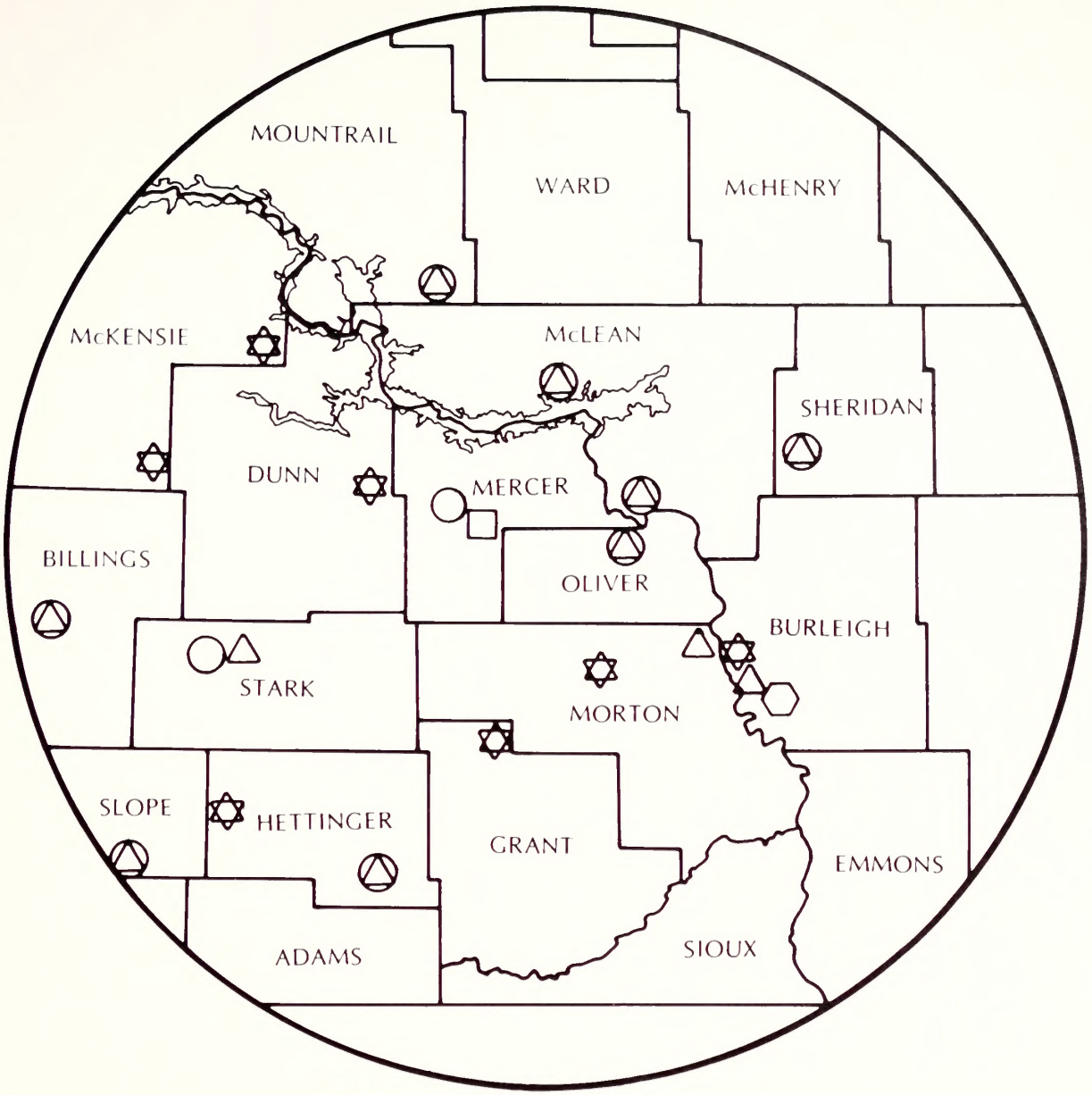
GLENHAROLD MINE CLIMOGRAPH

SOURCE: Ramirez and Method 1976.

NOTE: Meterological Information from Center, North Dakota.

MAP 2-1

AIR QUALITY MONITORING SITES



○ Rural
△ Commercial
□ Residential
⬡ Industrial
✡ Regional Environmental Assessment Program
◬ Northern Great Plains Research Program

SOURCE: North Dakota State Department of Health, 1976

TABLE 2-2

AIR QUALITY SAMPLING STATIONS IN STANTON VICINITY

Sampling Site	Sampling Initiated	Contaminant Sampled	Type of Site
Beulah	April 1974	Total Suspended Particulate, Sulfation Rate, SO_2, NO_2	Urban
Beulah	July 1974	Total Suspended Particulate, Sulfation Rate, SO_2, NO_2	Rural
Stanton (Meterological Station) 1/	September 1974	Total Suspended Particulate, Sulfation Rate, SO_2, NO_2 (Bubbler), SO_2 and NO_x (Continuous), Cascade Impactor, Continuous Oxidant	Rural
Washburn	September 1974	Total Suspended Particulate, Sulfation Rate, SO_2, NO_2	Rural

1/ Wind speed, wind direction, ambient air temperature, barometric pressure, precipitation total, and pH also determined at station.

SO_2 = sulfur dioxide

NO_2 = nitrogen dioxide

NO_x = oxides of nitrogen

SOURCE: North Dakota State Department of Health 1976

TABLE 2-3

AMBIENT AIR QUALITY SAMPLING DATA FROM SELECTED NORTH DAKOTA URBAN AND RURAL AIR SAMPLING SITES DURING 1976

Contaminant	Beulah(U)[1]	Beulah(R)[2]	Stanton(R)	Washburn(R)
Total Suspended Particulate				
Maximum, 24-hour (ug/m^3)[3]	148	81	150	127
Times exceeding 150 ug/m^3 (days)	0	0	0	0
Annual geometric mean (ug/m^3)	49	24	31	28
Sulfur Dioxide				
Maximum, 24-hour (ug/m^3)	[4]	[4]	[4]	[4]
Annual arithmetic mean (ug/m^3)	[4]	[4]	[4]	[4]
Reactive Sulfur (mg $SO_3/100cm^2/day$)[5]				
Maximum, 1-month period	0.2	0.1	0.1	0.1
Annual arithmetic mean	0.03	0.01	/ 0.01	/ 0.01
Nitrogen Dioxide (ug/m^3)				
Maximum, 24-hour	33	16	33	14
Annual arithmetic mean	16.75	2.8	7.96	1.33

1/ Urban
2/ Rural
3/ micrograms per cubic meter
4/ Below detectable concentration of 5 ug/m^3
5/ milligrams of sulfur trioxide per 100 square centimeters per day

SOURCE: North Dakota State Department of Health 1976

TABLE 2-4

NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS FOR
PARTICULATES, SULFUR OXIDES, AND NITROGEN DIOXIDE

Contaminant	Maximum Permissible Concentrations	
	Short-Term Standards	Long-Term Standards
Total Suspended Particulate	150 ug/m^3 1/, maximum 24-hour concentration not to be exceeded more than once per year	60 ug/m^3, maximum annual geometric mean
Sulfur Dioxide	260 ug/m^3, maximum 24-hour concentration 715 ug/m^3, maximum 1-hour concentration	60 ug/m^3, maximum annual arithmetic mean
Reactive Sulfur	0.50 mg sulfur trioxide per 100 cm^2/day 2/ maximum for a 1-month period	0.25 mg sulfur trioxide per 100 cm^2/day maximum annual arithmetic mean
Nitrogen Dioxide	100 ug/m^3, maximum 1-hour concentration not to be exceeded over 1% of the time in any 3-month period	100 ug/m^3, maximum annual arithmetic mean

1/ micrograms per cubic meter

2/ milligrams sulfur trioxide per 100 square centimeters per day

SOURCE: North Dakota State Department of Health 1976

TABLE 2-5

TONS PER YEAR PARTICULATE EMISSIONS FROM POINT AND AREA SOURCES IN MERCER AND OLIVER COUNTIES - 1976

Source	Mercer County	Oliver County
Point Sources[1/]	1,217	70
Area Sources[2/]		
Fuel Combustion:		
1. Lignite coal	127	52
2. Distillate oil	5	2
3. Residual oil	4	1
4. Natural gas	0	0
5. LPG	2	neg.
Burning:		
6. Open burning	neg.	5
Mobile Sources:		
7. Highway vehicles	27	14
8. Off-highway	33	23
9. Railroads	1	1
Fugitive Dust:		
10. Unpaved roads	16,180	10,240
11. Agriculture	3,439	2,551
12. Construction	0	160
13. Mining	1,587	437
14. Paved roads	102	49
Total Point and Area Source Emission	22,724	13,605

neg. = negligible amounts

SOURCES:
1/ North Dakota State Department of Health, unpublished data 1976.

2/ North Dakota Air Quality Maintenance Area Analysis
U.S. Environmental Protection Agency Publication No. EPA-908/1-76-009

Particulate emissions from point sources (power plants and other industrial sources) and mining operations account for 12% and 4% of the respective total estimated particulate emissions for Mercer and Oliver Counties. Mining operations (considered independently) contribute 7% and 3% of the respective particulate totals for Mercer and Oliver Counties. Of the 1,587 tons per year mining emissions, shown in Table 2-5 for Mercer County, an estimated 1,090 tons per year are from the Glenharold Mine activities. The Glenharold mining operation, therefore, produces about 5% of total particulate emissions from all sources in Mercer County.

Air quality trends have been examined by the North Dakota State Department of Health by comparing 1976 particulate emissions with those projected for 1980 and 1985. This examination shows that, if the Glenharold Mine ceased to operate, a projected annual average air quality improvement of approximately 1.5 micrograms per cubic meter would not be discernible by current air sampling methods.

Short-Term Application Area

Particulate quantities of the magnitude discussed for the project area would occur, in proportion to acreage involved, due to mining related earth and overburden disturbance and haul road use, if federal coal within the short-term application area were to be leased and mined.

GEOLOGY

Project Area

Topography

Bedrock in the project area is commonly exposed at the surface, and the terrain may be described as glacially modified bedrock topography. A mantle of glacial drift rests on the preglacial surface, and the general effect of the drift has been to decrease the relief. The Knife and Missouri Rivers and their large tributaries are in glacial or preglacial valleys that were eroded into the Tongue River Formation (Carlson 1973).

The Glenharold Mine area is on a dissected plateau between the terraces which border the broad, flat Missouri River flood plain to the northeast and a broad, gently rolling upland to the southwest. The plateau is the area of broken land at the border of the upland. The plateau is dissected by ravines and is commonly referred to as breaks. The plateau ranges from about 300 to 430 feet above the Missouri River flood plain, and, locally, the relief is as much as 300 feet. The active mine area ranges in altitude from 1,780 to 2,080 feet and the average is about 1,900 feet. Headward erosion by the northeastward-trending ephemeral streams has produced a dendritic pattern of narrow, steep-walled valleys.

Physiographic features in the area include flood plains, terraces, sand dunes, a dissected plateau, and an upland area (Map 2-2). A generalized physiographic profile of the project area is shown in Figure 2-3.

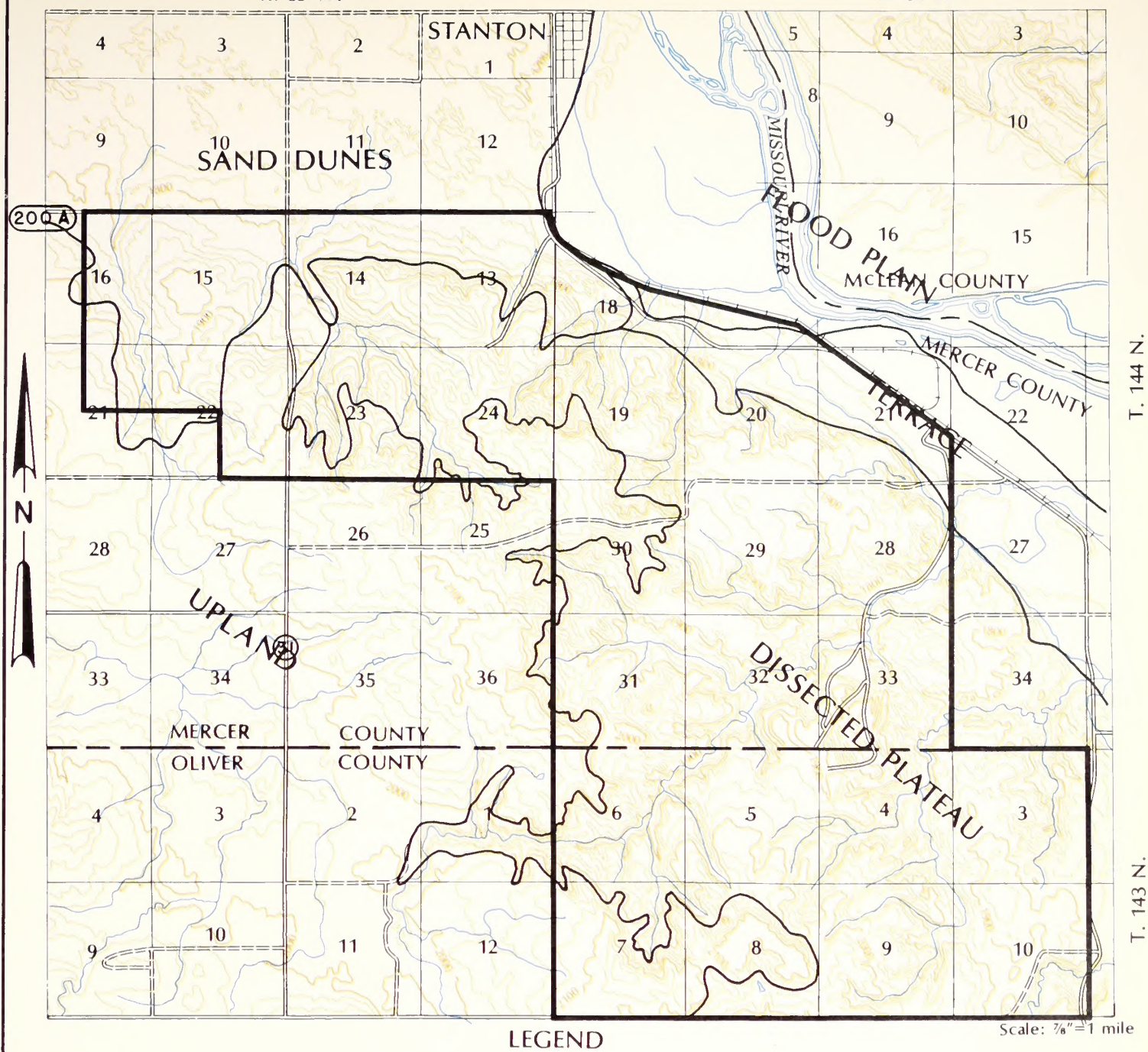
Stratigraphy

The four sedimentary formations exposed in the vicinity of the Glenharold Mine range in age from 65 million years (Tertiary) to the present time (Holocene). Their distribution in the area is shown on the geologic map (Map 2-3). From oldest to youngest, they are the Tongue River, Sentinel Butte, Coleharbor, and Walsh Formations. Much of the geologic information given below is taken from Carlson (1973) unless otherwise indicated.

The Tongue River Formation of Early Tertiary age (Paleocene, about 60 million years old) is nonmarine and contains the coal beds that are being mined. Carlson (1973) described the Tongue River Formation as about 375 to 450 feet of interbedded siltstone, claystone, sandstone, shale (thinly layered sediment), and limestone; but mainly siltstone and claystone. Two persistent sandstone beds occur in the Tongue River Formation. The most persistent is about 40 feet thick and is the lowest bed of the formation. A less persistent sandstone is commonly about 200 feet above the base of the formation. The various beds weather to light shades of yellow, gray, and brown. The thick, lens-shaped bodies of limestone weather yellowish gray and form resistant caps on knobs, ridges, and benches (Carlson 1973). Brownish gray, carbonaceous shale is commonly associated with the coal beds. The coal bed stratigraphy is incomplete; additional mapping and correlation of the coal beds are needed.

The Sentinel Butte Formation lies above the Tongue River Formation. It is also of early Tertiary (Paleocene) age and consists of interbedded siltstone, sandstone, shale, limestone, and coal. The

MAP 2-2



LEGEND

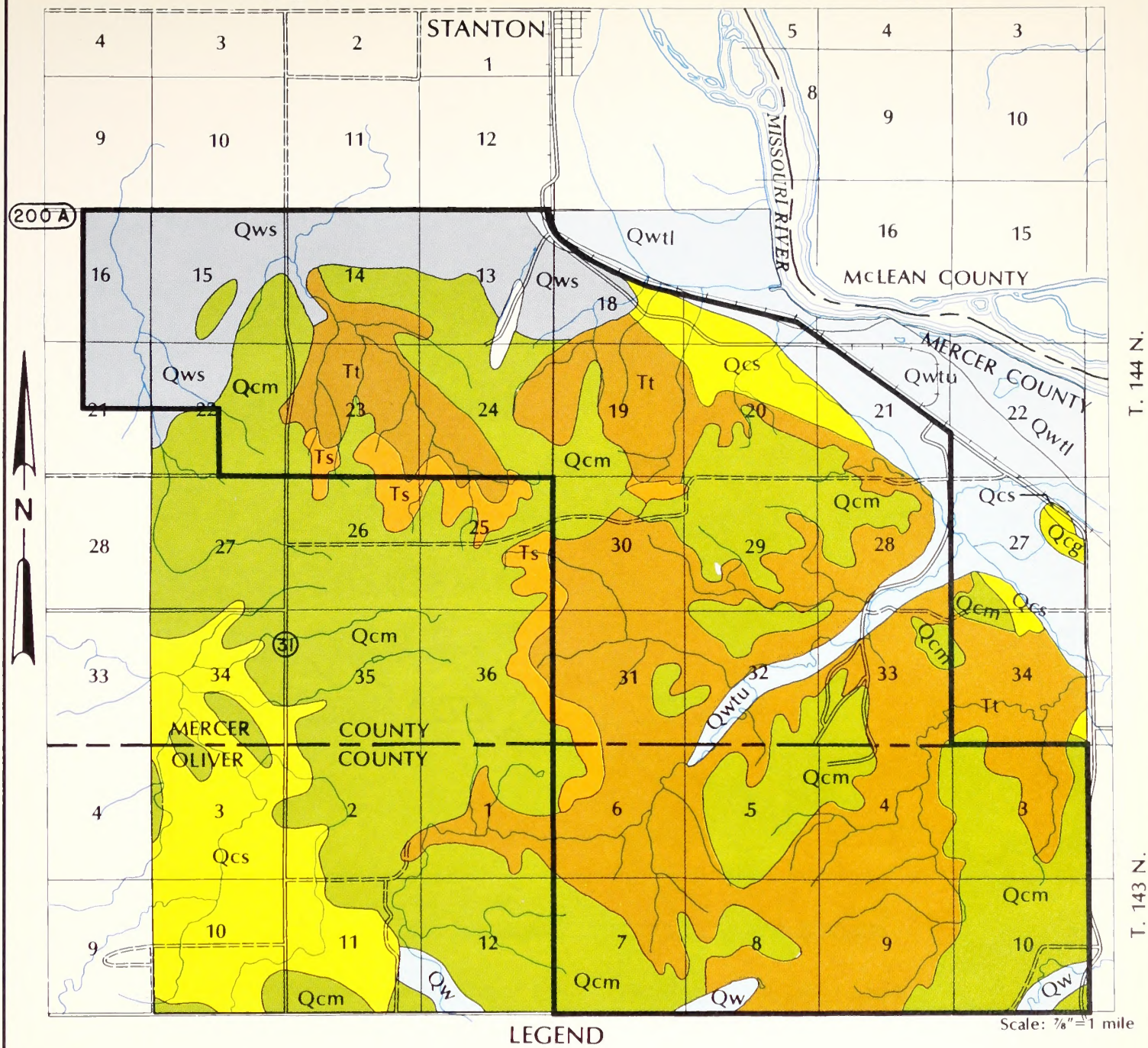
- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Contours (20' intervals)

Quaternary
Tertiary
Paleocene
Walsh
Cole Harbor
Sentinel Butte
Tongue River

TOPOGRAPHY OF GLENHAROLD PROJECT AREA

SOURCE: Geological Survey, 1977

MAP 2-3



Scale: 7/8"=1 mile

LEGEND

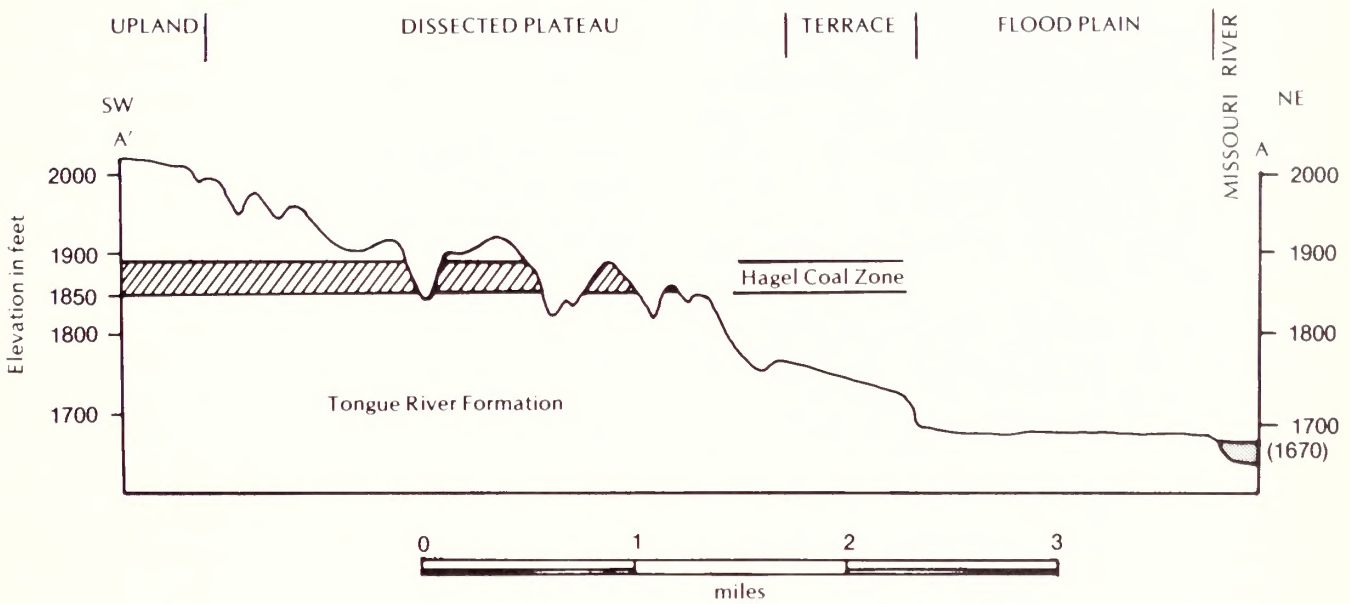
- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream

SYMBOL		FORMATIONS
QUATERNARY	Qw	WALSH
	Qwtu	
	Qwtl	
	Qws	
	Qcs	sand, gravel
	Qcg	COLEHARBOR
	Qcm	moraine
TERTIARY	Ts	SENTINEL BUTTE
	Tt	TONGUE RIVER

SOURCE: Carlson 1973

GEOLOGIC MAP OF THE GLENHAROLD PROJECT

Figure 2-3



TOPOGRAPHIC PROFILE OF GLENHAROLD PROJECT AREA

SOURCE: Bureau of Land Management 1976.

Sentinel Butte rocks weather to darker brown and gray shades than the rocks of the Tongue River Formation. The Sentinel Butte Formation reaches a maximum thickness of about 350 feet in the region. Only about 40 feet of the formation is preserved along the drainage divides in the mine area.

The glacial deposits in the area are included in the Coleharbor Formation (Bluemle 1971). The Coleharbor consists of numerous alternating beds but only three main facies.

The Boulder Clay facies is a till that includes fragments ranging in size from boulders to clay particles. In much of the area, it is a mantle or till cover that is only a few feet thick. Underlying bedrock relief is largely duplicated by the upper surface of the Boulder Clay facies. The present drainage pattern probably is only slightly different from the pattern that existed before the till was deposited. Kume and Hansen (1965) used the term "sheet moraine" to describe this facies.

The Gravel facies of the Coleharbor Formation consists of glacial sand and gravel that probably was either an ice contact deposit or outwash. On Map 2-3, the Gravel facies is identified as "glacial terrace deposits." None of the Gravel facies lies within the project area.

The Sand facies of the Coleharbor Formation is a well sorted and stratified series of sand and silt beds, with some included gravel. It is probably an outwash deposit. In places, the Sand facies appears to overlie the till, or Boulder Clay facies.

Holocene (recent) age deposits compose the Walsh Formation (Map 2-3). Four units of the formation present in the project area are identified by Carlson (1973). One unit consists of well sorted, fine to medium-grained sand; it forms large sand dunes northward from the project area. Two units are the alluvial deposits beneath the lower and upper terraces, respectively, along the Missouri River. The fourth unit is alluvium deposits on the flood plains and lowland areas of the Missouri River and its principal tributaries. It consists of silt, fine to coarse sand, and gravel; and contains fragments of weathered coal, clinker, and fossilized wood. Commonly, it is dark brown, gray, or black.

Gravel is generally scarce southwest of the Missouri River. Terraces along the major and some minor streams constitute the only significant source of gravel. Glaciofluvial deposits of gravel, or sand and gravel, occur in isolated mounds and ridges in the glaciated areas. Most of these deposits are small, are characterized by abrupt changes in quality, may contain a considerable quantity of clay, and are of little commercial value. In the project area, none of the sand, sand and gravel, or gravel deposits are economically important at present.

Overburden Characteristics

The overburden in the project area is mainly shale, claystone, and a little sandstone, all mantled locally by glacial till as much as 40 feet thick (Johnson and Kunkel 1959, Carlson 1973). The shale and claystone are various shades of olive gray, yellowish-brown, and black. The brownish hues occur in weathered or oxidized zones. The glacial till consists of a compact, nearly impervious mixture of particles ranging in size from very small clay grains to boulders. The matrix of the till is mainly calcareous clay and silt.

High walls and end cuts in the Fort Union Formation are usually stable during the course of strip mining, but they have been observed to deteriorate with time (Lee et al. 1976) at places in Montana and Wyoming. There, small post-mining landslides are common, particularly when the cuts are left standing for several months. The clay-rich parts of the formation tend to slide and slump on both artificial and natural slopes, particularly when saturated during spells of wet weather. Also, some of the clay-rich rocks shrink and crack on drying because they contain clays of the montmorillonite group of minerals. Some overconsolidated clays may expand and crumble when the overlying sediment is removed.

Spoil from the excavation of overburden at the Glenharold Mine is described (Sandoval et al. 1973) as dominantly clay mixed with minor amounts of sand and silt particles. The predominant clay minerals are in the montmorillonite group.

Chemical analyses of the spoil (Sandoval et al. 1973) indicate that it is alkaline (pH about 8.3) and slightly saline. The sodium content is high as indicated by sodium adsorption ratios of 19 and 29. Sodium adsorption ratio values greater than 12 are an indication of potential revegetation problems. Sodium sulfate is the major soluble salt. Chemical analyses of undisturbed overburden from drill holes indicate that the alkalinity remains relatively constant with depth except in coal zones which are neutral (pH=7.0) to mildly acidic (pH of 4.5 to 6.9). The sodium adsorption ratio values increase to as much as 39 with depth (Sandoval et al. 1973). These characteristics indicate that the overburden would be unsuitable for vegetative growth material.

Mineral Resources

Coal

Two minable beds of the Tongue River Formation occur in the mine area. They are separated by 20 to 50 feet of sedimentary rock.

There are several different names for the coal beds in the project area. The coal beds' names used here are the Geological Survey Conservation Division's designation.

The lower seam, known as the Stanton bed, varies from 7 to 12 feet thick in the mine area except where an overlying seam merges with it to increase the thickness to about 15 feet. The base of the Stanton bed is about 275 feet above the base of the Tongue River Formation. It is the primary mining seam in the Glenharold Mine and may be mined economically to an overburden depth of 100 feet.

The next ascending bed, known as the Hagel bed, ranges from 4 to 6 feet thick in the project area. This bed may have as many as three splits (benches). The present economics of mining are such that recovery is limited to those split seams that are three feet thick or more and where the separation between split seams is less than 2 feet thick. Recoverable reserves calculated for the short-term lease application also include the next overlying coal bed, identified as the Upper Hagel, where it exists and where thickness is sufficient for recovery.

A two foot seam about 10 feet below the Stanton bed is too deep to be recovered. Thin coal beds occur beneath the Stanton bed (Carlson 1973) in the NE1/4 SE1/4 Section 3, T. 143 N., R. 85 W. (Map 2-2). There, a six foot coal bed and a five foot coal bed lie 30 and 105 feet, respectively, below the Stanton bed.

The company provided the following average analysis (presumably the arithmetic mean of a large number of samples) of coal from the mine area:

Moisture - 38.0%

Volatiles - 27.0%

Ash - 5.0%

Sulfur - 0.4%

Btu - 6,860/lb.

Detailed analyses of coal from the mine are presented in the Mineral Resources Work Group Report (Northern Great Plains Resource Program 1974).

Analyses of two coal samples done by Commercial Testing and Engineering in 1962 to determine the major oxide content (Table 2-6) and the results of analyses for 12 trace elements determined by the Geological Survey (Northern Great Plains Resource Program 1974) are shown in Table 2-7.

At least 85 million tons of coal are estimated to lie beneath overburden to an average depth of 110 feet thick in the project area.

Oil and Gas

There are no producing oil or gas wells nor are there any federal or state oil and gas exploration leases in the project area. At least 31 test wells have been drilled in the Mercer and Oliver County area, two of which reported oil and/or gas shows (Petroleum Information Corporation). However, half of the tests were relatively shallow and did not penetrate deeper lying (Triassic and older) potential host rocks. Further exploration and interest in the oil and gas potential of the area is likely to continue.

Clay

Clay is abundant in the Sentinel Butte Formation. Although it is either too silty or contains deleterious materials that render it unsuitable for use in ceramics, it could be utilized for lightweight aggregate.

Other Mineral Materials

The project area contains leonardite, clinker, and gravel of potential economic interest. Leonardite is associated with nearly all coal deposits in North Dakota. It is a soft, earthy, medium brown, coal-like substance that results from the oxidation of coal (Fowkes and Frost 1960; and Fowkes 1973). Leonardite is a poor fuel, but it can be used as a source of chemicals. It has been used in small amounts for many years as a dispersant and viscosity control in oil-well drilling muds, as a stabilizer for ion-exchange resins in water treatment, as a soil conditioner, and as a source of water-soluble brown stain for wood finishing. Well logs for the mine area indicate that the coal contained in the thin seams overlying the minable beds is soft, which indicates that it is more or less oxidized and could be considered a source of leonardite.

Sand and gravel deposits occur in minor amounts in alluvium along drainageways, as isolated patches on the uplands, and in terrace deposits.

TABLE 2-6

CHEMICAL ANALYSES OF COAL, GLENHAROLD MINE

	Sample 1	Sample 2
ULTIMATE ANALYSIS - Dry Basis*		
% Carbon	61.31	64.50
% Hydrogen	4.67	4.72
% Nitrogen	1.04	1.01
% Chlorine	1.01	0.01
% Sulfur	1.51	1.14
% Ash	10.90	9.30
% Oxygen (diff.)	20.56	19.32
	100.00	100.00
ASH ANALYSIS - Ignited Basis		
Phos. pentoxide, P_2O_5	0.36	0.35
Silica, SiO_2	19.92	32.44
Ferric oxide, Fe_2O_3	8.71	10.68
Alumina, Al_2O	9.05	14.40
Titania, TiO_2	0.37	0.32
Lime, CaO	26.68	18.43
Magnesia, MgO	5.33	5.35
Sulfur trioxide, SO_3	19.59	15.46
Potassium oxide, K_2O	0.52	0.81
Sodium oxide, Na_2O	8.63	0.82
Undetermined	0.84	0.94
	100.00	100.00
% Alkalies as Na_2 - Dry Coal Basis	0.98	0.13

*"Ultimate analysis" is the determination, in a testing laboratory, of the elemental composition of coal in terms of percent ash, carbon, hydrogen, oxygen, nitrogen, and sulfur.
The user of these analyses should exercise caution with respect to the relative percentages of elements as presented because original moisture content of the coal is not included in the calculation. The values on a "dry coal basis" are therefore higher than those for moist coal.

SOURCE: Commercial Testing and Engineering, unpublished data 1962.

TABLE 2-7

TRACE ELEMENTS IN COAL SAMPLES
GLENHAROLD MINE

Sample No.	D165564	D165566	D165565	D165567
Element (ppm)	Berg (upper) Bed[1/]		Hagel (lower) Bed	
Arsenic	10	15	5	5
Cadmium	/ 0.1	/ 0.1	/ 0.1	/ 0.1
Copper	3.4	3.6	6.4	2.4
Fluorine	/20	/20	/20	/20
Mercury	0.10	0.08	0.09	0.05
Lithium	1.0	0.6	1.2	0.5
Lead	/ 1.5	2.0	/ 1.5	/ 1.5
Antimony	0.2	0.4	0.7	3.0
Selenium	0.7	0.8	0.8	0.5
Thorium	9.4	/ 2.0	/ 2.0	/ 2.0
Uranium	2.1	0.6	1.1	0.6
Zinc	1.4	1.3	2.2	2.3
Ash (percent)	7.02	6.32	7.16	5.78

Quantitative values determined in the laboratories of the U.S. Geological Survey, Denver, Colorado. Values for cadmium, copper, lithium, lead, and zinc are calculated from analyses on ash of coal.

1/ Sample interval four feet thick.
2/ Sample interval seven feet thick.

SOURCE: U.S. Geological Survey, in Northern Great Plains Resource Program 1974.

Clinker, the baked and fused rock that lies above coal that burned at some time in the past, is commonly quarried and used as road metal in North Dakota. The extent of clinker deposits in the project area has not been determined. Johnson and Kunkel (1959), however, indicate that outcrops of clinker are abundant in the southern portion of the project area.

Fossils

Fossils in the sedimentary rocks of the area are scarce. Complete leaf imprints may be found by diligent search among the clinker beds, and petrified wood may be found in the coal beds. According to Carlson (1973), some of the light colored clay beds may yield fragile shells of gastropods. It is not known, however, whether or not significant paleontologic resources exist on the tract.

Short-Term Application Area

The previous discussion on topography and stratigraphy also includes the lease application area.

Of the 1,668 acre short-term area, 983 surface acres overlie coal reserves to a depth of approximately 110 feet. Inplace coal reserves are estimated at 21 million tons, representing about 25% of the remaining unmined coal within the project boundary.

Coal analyses are shown in Table 2-8.

An additional 291 surface acres are underlain by roughly 5.8 million tons of inplace federal coal that falls outside the short-term area but within the project boundary.

The previous discussion on oil and gas, clay, other mineral materials, and fossils are applicable to the short-term area also.

SOILS

Project Area

Soil data for the Oliver County portion of the Glenharold project area were taken from a published Order III soil survey report done by the Soil Conservation Service. Additional data for Mercer County came from comparable unpublished Soil Conservation Service survey information. The soil surveys of the Glenharold project area conform to the latest acceptable practices of the National Cooperative Soil Survey Program. Mapping units are based upon soil types with similar properties. Separation is at the series level.

Soils within the project area are formed primarily from glacial till, shales, siltstones, and sandstones, with additional material derived from water deposited alluvium and windblown sand. Of more than 70 soil units identified in the 15,223 acre Glenharold Mine project area, the predominant units consist of upland soils derived from glacial till and soft bedrock. The materials include loamy glacial till, loamy sediments underlain by sand and gravel, sandy and silty material from siltstone and sandstone bedrock, and mixed alluvium in the valleys.

Land Capability

Of primary value in management of project area lands for agricultural productivity and watershed quality is classification of soils by land capability. Soil capability grouping makes possible broad generalizations based on soil potentials, limitations in use, and management problems. Criteria for capability classification include slope, soil texture, soil depth, effects of past erosion, permeability, water-holding capability, and other permanent soil properties.

On a general level, soils are grouped into eight capability classes. Limitations in use or risks of soil damage become progressively greater from Class I to Class VIII. Soils in the first four classes are capable, under good management, of long time sustained production of adapted cultivated crops such as wheat or barley. Soils in Classes V through VII will support native plants or adapted range species. Project area land capability classes are displayed in Map 2-4.

Within the project area, lands of Classes II, III, IV, VI, and VII occur. Acreages and percentages are given in Table 2-9. Of the total project, approximately 18% has been classified as Class II land. Within these areas, those mapping units designated as national prime farmlands (5% of the project area) include 60% or greater amounts of lands capable of producing a locally adapted crop (such as alfalfa, wheat, or barley) in seven out of ten years. While national prime farmlands have been designated by the Surface Mining Control and Reclamation Act regulations as unsuitable for strip mining, they may be disturbed with stipulated pro-

TABLE 2-8

COAL ANALYSIS

STANTON BED

As Received Basis	Range (in %)	Average (in %)
Moisture	29.81 - 41.18	37.82
Volatile Matter	23.93 - 29.31	26.62
Fixed Carbon	23.06 - 30.48	28.01
Ash	4.47 - 19.41	7.60
Sulfur	0.30 - 1.64	0.68
BTU	4979 - 7097	6622
Sodium		
Ash Basis	0.86 - 15.80	8.90
Coal Basis	0.09 - 0.68	0.20
Dry Basis		
Moisture	0.00 - 0.00	0.00
Volatile Matter	39.33 - 48.66	43.08
Fixed Carbon	38.36 - 49.27	45.56
Ash	7.38 - 20.80	11.26
Sulfur	0.48 - 2.33	1.10
BTU	9653 - 11563	10833

HAGEL BED

As Received Basis	Range (in %)	Average (in %)
Moisture	32.85 - 41.93	38.17
Volatile Matter	24.12 - 30.22	26.47
Fixed Carbon	25.68 - 30.89	29.04
Ash	3.37 - 14.38	6.31
Sulfur	0.31 - 1.11	0.59
BTU	6151 - 6953	6684
Sodium		
Ash Basis	0.96 - 16.80	7.43
Coal Basis	0.03 - 1.53	0.30
Dry Basis		
Moisture	0.00 - 0.00	0.00
Volatile Matter	36.80 - 49.13	42.84
Fixed Carbon	40.57 - 50.41	47.01
Ash	5.81 - 21.42	10.14
Sulfur	0.49 - 2.91	0.96
BTU	9337 - 11245	10820

SOURCE: Consolidation Coal Company 1978

TABLE 2-9

LAND CAPABILITY

Land Capability Class	Glenharold Project Area Acres	Percent	Estimated Coal Reserve Area Acres	Percent
II	2,705	18	606	17
III	1,759	12	393	11
IV	1,417	9	461	13
VI	2,702	18	757	21
VII	4,450	29	1,330	38
Other Land Cover 1/	2,190	14	--	--
TOTAL	15,223		3,547	

1/ Includes mined land, mine dumps, gravel pits, and cut-and-fill land. These areas are too variable to rate; on-site investigation is necessary.

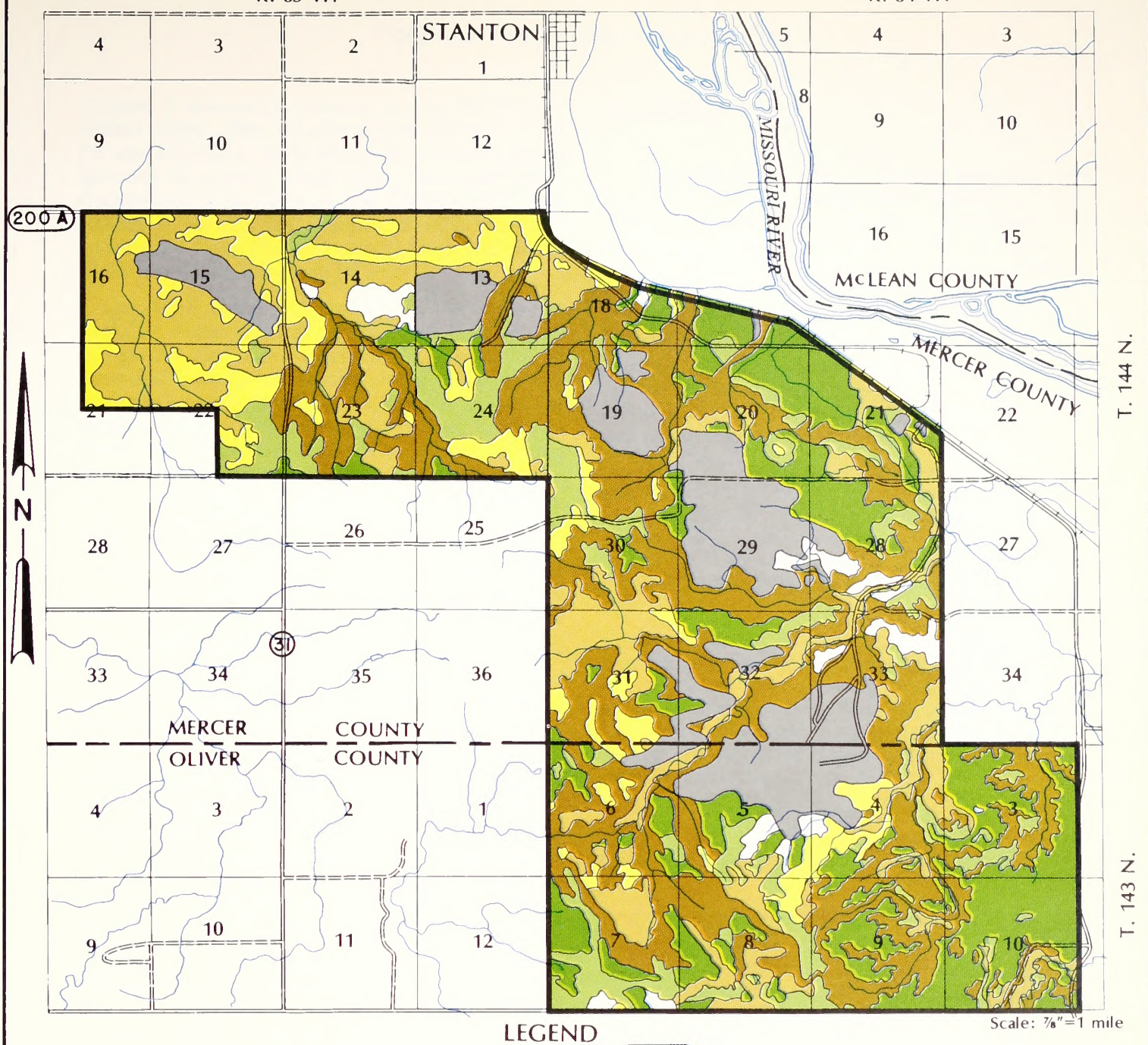
SOURCE: Pointer 1977, based on unpublished Soil Conservation Service data.

TABLE 2-10

NATIONAL PRIME AND STATEWIDE IMPORTANT FARMLAND

	Glenharold Project Area Acres	Percent	Estimated Coal Reserve Area Acres	Percent
National Prime Farmland	682	5	193	5
Statewide Important Farmland	3,717	24	654	18
Other Land Cover	10,824	71	2,700	76
TOTAL	15,223		3,547	

SOURCE: Pointer 1977, based on unpublished Soil Conservation Service data.



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream

- Class II Lands
- Class III Lands
- Class IV Lands
- Class VI Lands
- Class VII Lands
- Disturbed Lands

Note: Risks of soil damage or limitations on use become progressively greater from Class II to Class VII.
Soils in classes II, III, and IV, under good management, are capable of producing adapted cultivated field crops.
Soils in classes VI and VII are suited to the use of adapted native plants

SOURCE: Pointer 1977

Note: Based on Soil Conservation Service Data

LAND CAPABILITY CLASSES

cedures if successful reclamation can be demonstrated. Since initial soil analysis for the Glenharold ES was initiated in 1976, 46 acres of national prime farmland have been mined within the project area. Reclamation in accordance with SMCRA and North Dakota Public Service Commission stipulations is underway. One hundred ninety-three additional acres have been proposed for mining.

Additional Class II lands and some well-drained Class III lands with rolling slopes (6 to 9%) predominating, have been designated as farmlands of statewide importance. Farmlands of statewide importance do not qualify under federal criteria for consideration as national prime or unique farmlands under the National Environmental Policy Act, but are of sufficiently high quality to warrant designation as important to the state of North Dakota. Approximately 24% of the project area falls into the statewide important farmlands category. Acreage extent and percentages of both national prime farmland and statewide important farmland are given for the estimated coal reserve area and total project area in Table 2-10.

Map 2-5 displays national prime farmland and statewide important farmland distribution within the project area.

Class III lands comprise some 12% of the project area, with potential for long time production of grain crops, under good dryland management. With careful management, Class IV lands, 9% of the project area, also are capable of grain crop production. Class VI lands, comprising 18% of the project area, primarily are adapted to native range utilization.

Class VII lands are the predominant land cover, totaling 29% of the project area. These lands have very severe agricultural limitations, such as steep slopes, erosion, shallow soil, stones, wet soil, sodium problems, or high salinity. They are unsuited to cultivation and their use is restricted to grazing or wildlife habitat. Cabba-Werner complexes derived from interbedded sandstones, siltstones, and shales, with hilly and steep slopes, predominate.

Productivity estimates for the project area average 1,869 pounds of dry forage per acre (based on unpublished Soil Conservation Service data). Class VII lands, however, average 1,502 pounds; and of these, the Rhoades and Ringling soils produce but 725 pounds. Productivity estimates by land capability class are given in Table 2-11.

Erodibility

Susceptibility of soils to erosion by water and wind determines, in a large part, the management systems necessary for sustained agricultural production and watershed quality. Erodibility of soils in the project area by water is summarized in Table 2-12. Approximately 53% of the project area, comprised primarily of Cabba-Werner complexes, is highly susceptible to water erosion.

Volume of soil loss due to water erosion depends on soil physical strucure and particle size; amount, intensity, and distribution of precipitation; and length and steepness of slope.

Table 2-13 summarizes estimated water erosion soil losses from bare ground, in tons per acre per year, for typical project area soil textures, given various slope steepnesses and lengths. These losses might be expected in a worst case management situation with bare, summer fallow ground, for example.

Approximately 23% of the total project area is rated severe in wind erosion susceptibility. Erodibility of soil by wind depends on soil structure and length of susceptible distance. Estimated wind erosion soil losses from bare ground for typical soil texture groups, other various exposed distances, is given in Table 2-14.

Ongoing Mining and Reclamation

Of the disturbed lands within the Glenharold Mine project area, mined acreage totals 1,978 acres. Some 160 acres of leased federal coal reserves have been mined and an additional 111 acres of leased minable federal coal reserves have been permitted.

In 1974, a five-year mined land reclamation research project was initiated, in cooperation with the Northern Great Plains Research Center. Called the "wedge," the experiment was designed to test various depths of suitable plant growth material under different varieties of vegetation. Preliminary data indicates that two inches of suitable plant growth material "applied over impermeable highly sodic spoils dramatically improved plant growth and production and reduced surface crusting and runoff" (Power et al. 1976). The two inches of suitable plant growth material acted as a permanent mulch preventing the surface of the spoil from sealing. Plant growth and yield increased as depth of soil material increased to about 28 inches in thickness. Increases to eight feet did not significantly increase maximum yield of grain and grass revegetation spe-

TABLE 2-11

PRODUCTIVITY BY LAND CAPABILITY CLASS[1/]

Land Capability Class	Glenharold Project Area	Estimated Coal Reserve Area
II	2,299	2,275
III	2,225	2,177
IV	2,085	1,892
VI	1,758	1,415
VII	1,502	1,583
Other Land Cover[2/]	--	--
Area Average	1,869	1,787

1/ Pounds of dry forage per acre

2/ Too variable to rate

SOURCE: Pointer 1977, based on unpublished Soil Conservation Service data.

TABLE 2-12

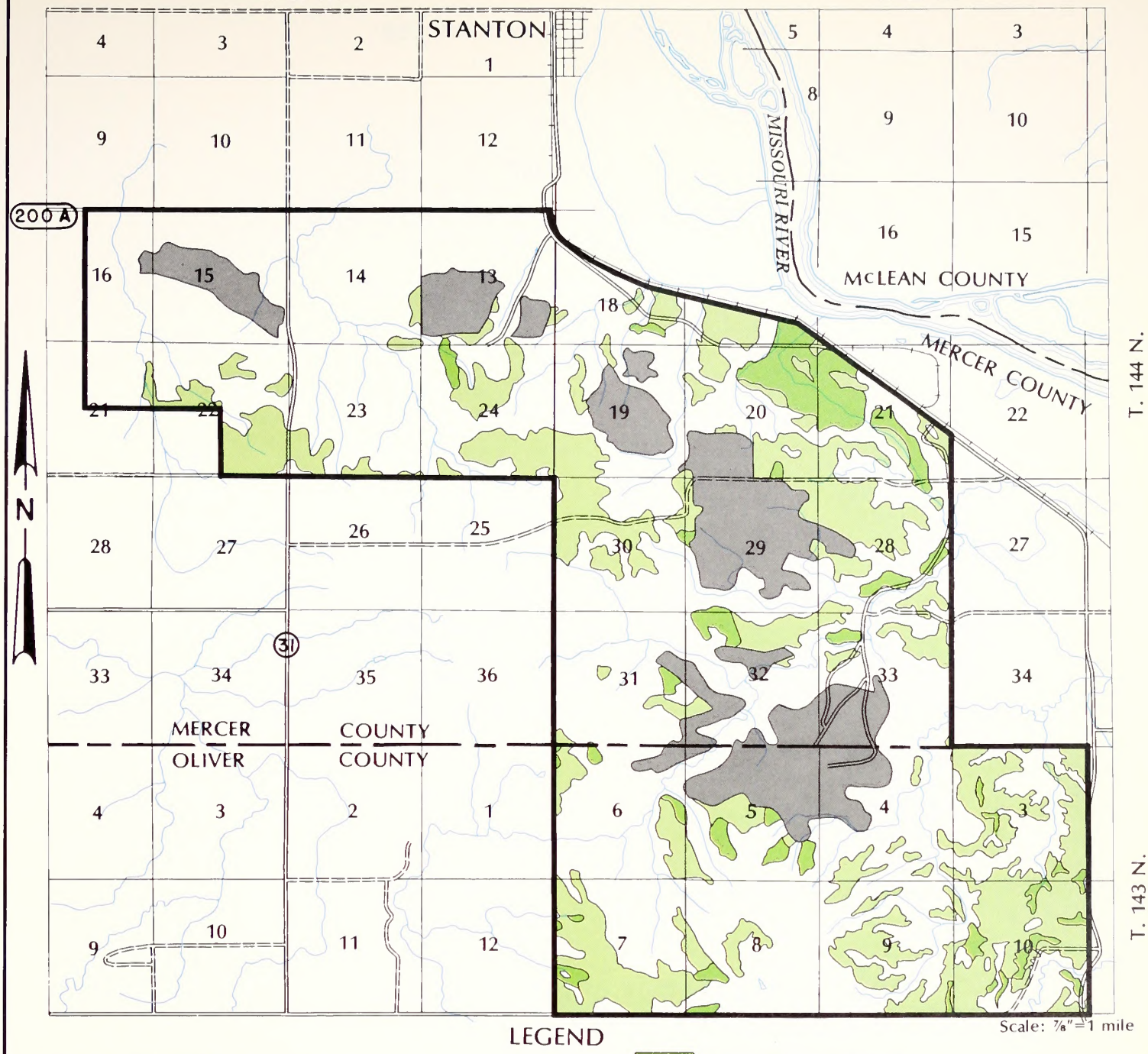
WATER ERODIBILITY

Erodibility	Glenharold Project Area Acres	Percent	Estimated Coal Reserve Area Acres	Percent
Slight to Moderate	4,980	33	1,206	34
High to Very High	8,053	53	2,341	66
Other Land Cover[1/]	2,190	14	--	--
TOTAL	15,223		3,547	

1/ These areas are too variable to rate; on-site investigation is necessary.

SOURCE: Pointer 1977, based on unpublished Soil Conservation Service data.

MAP 2-5



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- National Prime Farmland
- Statewide Important Farmland
- Areas Mined Since Soils Were Mapped

SOURCE: Pointer 1977

Note: Based on Soil Conservation Service Data

NATIONAL PRIME FARMLAND AND STATEWIDE IMPORTANT FARMLAND

TABLE 2-13

WATER EROSION SOIL LOSSES FROM BARE GROUND
(tons per acre per year)

Soil Textures	100-Foot Slope Length (per acre)			300-Foot Slope Length (per acre)		
	2%	10%	16%	2%	10%	16%
North Dakota						
Sandy	2	12	24	2	20	41
Silty	3	20	40	4	34	64
Clayey	4	26	53	5	44	82
Rocky Shaly Subsoil	5	34	70	9	59	118

SOURCE: From data developed by Alaska Natural Gas Transportation System, Final Environmental Impact Statement 1976; USDA, Reclamation Research Staff 1977; and Soil Conservation Service using the Universal Soil Loss Equation.

TABLE 2-14

POTENTIAL WIND EROSION SOIL LOSSES FROM BARE GROUND
(tons per acre per year)

Soil Texture Group	Distance Exposed to Wind (feet)					
	50	100	200	500	1,000	10,000
Sandy	5.0-18.0	11.0-27.0	15.5-24.5	23.0-44.5	29.0-51.0	34.5-53.5
Silty	.05	1.5	3.0	6.0	9.6	15.0
Clayey	2.5	5.7	10.0	15.5	19.5	26.0

SOURCE: From Alaska Natural Gas Transportation System, Final Environmental Impact Statement 1976.

cies. Preliminary experimental evidence indicates that mined land productivity could be restored to 100% of the original potential if the sodic spoil material were buried to the depth of the rooting zone of the plant species to be replanted. Wheat yields on a 10.5 acre test plot were 17 bushes per acre under 1976 drought conditions, up one bushel from first year yields in 1975, and comparable to unmined cropland yields in the area. Reclamation of the 10.5 acre plot cost approximately $4,400 per acre.

Within areas being mined in section 15, up to ten feet of silt occurs in the upper level of the overburden, immediately beneath sandy surface soils. Determined by the North Dakota Public Service Commission (PSC) to be suitable plant growth material, this silt material has been saved and utilized for respreading over the recontoured spoils, in accordance with PSC stipulation. Within these silty areas with higher water holding capacity, post-mining productivity will exceed that of the pre-mining sandy soils.

Future Trends

Erosion, principally from bare ground and summer fallow fields, would continue. Maximum rates would be comparable to those estimated in Table 2-13 for water erosion, and Table 2-14 for wind erosion. Productivity for undisturbed existing land capability classes is not expected to change appreciably, nor is the pattern of agricultural utilization of the various soil units.

Continued mining within the Glenharold project area without the proposed action or additional leasing of federal coal would involve an additional 2,200 acres, with continued mining through 1994. Mining would disturb an additional 155 acres per year through this period. With spoil storage and haul roads included, 211 acres would be disturbed each year. Based upon estimated project area productivity, in the short term some 394,000 pounds of dry forage would be removed from production each year. This loss in agricultural productivity would be temporary, as rehabilitated acreage is brought back into production. Preliminary research results indicate rehabilitation of project area mined land to pre-mining productivity is possible.

Short-Term Application Area

Within the short-term application area, concentrations of highly productive lands of Classes II and III occur in sections 20, 24, 30, and 32. A total of 53 acres are national prime farmland.

Lands of high to very high water erosion susceptibility, distributed throughout the area, encompass 1,150 acres, or 69%. Severe wind erosion susceptibility across 763 acres, primarily in sections 14, 22, and 24, also is a significant concern.

Only 16 acres, within sections 30 and 32, have sodium affected material within 20 inches of the soil surface.

Thin soils on steep to very steep slopes occur along drainages. Of the 453 acres of this terrain occurring within the short-term application area, 271 acres actually lie within areas under consideration for mining. Within sections 24 and 30, these soils are of significant area, 185 acres or 41%. These soils also are often associated with woody draw habitat.

WATER

Project Area

Surface Water

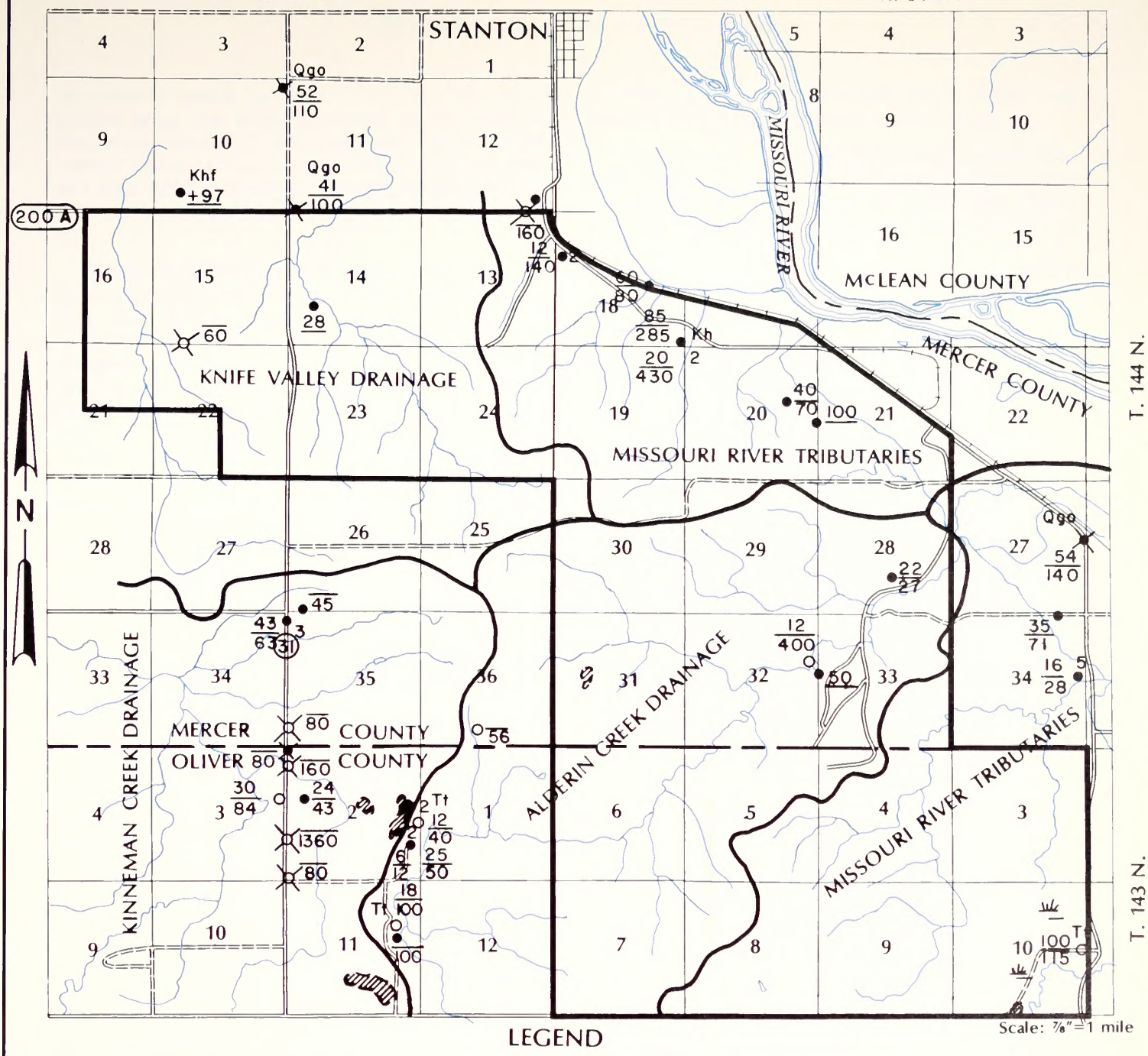
Water in the Glenharold Mine area is derived from snowmelt and rainfall. The average annual precipitation based on records from the weather station at Center, North Dakota, approximately 10 miles south of the mine, is 17.83 inches. Most of the precipitation is evaporated or transpired (removed by vegetation) after having been retained temporarily as soil moisture or ponded water.

Streams in the Glenharold project area are intermittent tributaries to the Knife River valley or to the Missouri River. They are not measured, but calculations by the Geological Survey (Orlo Crosby, personal communication) based on long-term stream-gauging records in adjacent areas, indicated that annual runoff from precipitation in the Glenharold Mine area averages about 1 inch over the entire land surface.

Unnamed tributaries to the Knife River valley drain about 5.84 square miles (3,740 acres) on the north side of the project area. Other small streams drain about 10.28 square miles (6,580 acres) to the Missouri. Alderin Creek drains about 7.66 square miles (4,900 acres) of the project area (Map 2-6).

If one inch of precipitation is runoff, the small tributaries to the Knife River valley carry about 310

MAP 2-6



Scale: ⅞"=1 mile

LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Drainage Divides
- Ponds, mostly ephemeral
- o Well
- Test Hole
- Chemical Analysis
- Tt Aquifer (See table 2–15 for identification)
- O_5 Multiple Wells at Site
- 40/70 Reported or Measured Depth to Water / Reported or Measured Depth of Well

SOURCE: Consolidation Coal Company, North Dakota Geological Society and U.S. Geological Survey 1977.

WELLS, TEST HOLES AND DRAINAGE PATTERNS

acre-feet of water per year from the Glenharold project area, the small tributaries to the Missouri discharge about 550 acre-feet, and Alderin Creek carries about 410 acre-feet of water from the project area. Alderin Creek also carries about 380 acre-feet from its headwater areas south of the mine site.

Water in ponds on the project area has not been sampled. This water is derived from precipitation; most has reached the ponds as runoff from tributary slopes and spoil piles. The quality of the ponded water is governed initially by the salts dissolved from the spoil piles and from the unmined lands. Biologic agents, both plants and animals, that use the ponds further modify the chemical quality of the ponded water by using the water and returning it to the ponds. Decaying plant and animal debris adds nitrates and phosphates to the water.

Ground Water

Recharge to ground water from precipitation on the Glenharold project area is negligible. The thin and isolated patches of glacial till at the surface have low permeability, and the bedrock strata beneath the till are predominantly shale. Many soils derived from the bedrock are clayey and will neither yield water readily to wells nor allow it to percolate through to a more permeable stratum. Glacial meltwater deposits are found in the valleys of the Knife and Missouri Rivers and of Kinneman Creek, which lies west of the project boundary, but they are absent from the Glenharold project area.

Ground water from consolidated strata in and adjacent to the Glenharold project area is obtained from aquifers below the Sentinel Butte Formation and above the base of the Fox Hills Formation. Most wells range from 40-430 feet in depth (Table 2-15 and Map 2-6). The aquifers are the Tongue River Formation, the Hell Creek-Cannonball-Ludlow aquifer, and the Hell Creek-Fox Hills aquifer. The deeper formations are not recharged in the project area. Their outcropping edges generally lie south and east of the site.

The Sentinel Butte Formation and the upper part of the Tongue River Formation outcrop in the project area, but they are principally composed of silty or clayey beds interspersed with lignite. Water in these beds is unused in the mine area and is not a dependable perennial water supply. The water is discharged as seepage on the slopes. It supports vegetation that grows after other plants have begun to dry and mature. It may sustain brushy or woody draws; however, woody draws that depend on seepage are indistinguishable from those that depend on accumulated snowmelt or runoff.

Wells in and near the Glenharold project area yield sodium or calcium bicarbonate or bicarbonate sulfate type water, as shown in Table 2-16. Water from wells that are less than 150 feet deep or that tap outwash deposits generally has a lower percentage of sodium and a lower sodium adsorption ratio than deeper wells.

Ongoing Mining and Reclamation

Within the Glenharold Mine project area, there are about 2,000 acres that have been mined. In many cases, these mined areas are adjacent to the short-term application area under consideration.

Both the surface and shallow ground water resources are presently affected by mining. Surface waters associated with the mined areas carry more sediment and possibly slightly higher concentrations of soluble salts. Ground water flow characteristics are different in the mined area as opposed to the unmined area. Water moves easily through the replaced overburden and may contain higher concentrations of soluble salts.

Future Trends

Increased sediment yield, slightly higher concentration of dissolved solids in surface water, and an increase in the concentration of dissolved solids in near surface ground water would continue in the area.

Continued mining without the proposed action would involve a total of about 2,200 acres and continue until around 1984. These additional areas would be impacted similarly to those areas already mined.

Short-Term Application Area

There are a total of 1,668 acres under short-term lease application. About 880 of the acres are in the unnamed tributaries to the Knife River valley; 316 acres are in the small tributary streams of the Missouri River; and 472 acres are in the Alderin Creek drainage. The average annual surface runoff from these areas is 132 acre-feet using 1 inch as the average runoff figure.

TABLE 2-15

WELLS AND TEST HOLES ADJACENT TO GLENHAROLD MINE

Local Well Number[1]	Well Depth (ft)	Water Level (ft)	Date Water Level Meas	Use[2]	Aquifer[3]	Specific Conductance	Source of Data[4]
143N84W							
10ADD	115	100	--	K	Tt	2700	NDGS
143N85W							
02DAD1	12	6	--	S	--	1700	NDGS
02DAD2	50	25	--	K	--	2400	Consol
144N84W							
18BCB1	140	12	6/67	S	--	550	NDGS
18BCB2	25	--	--	K	--	1900	NDGS
18DBA	80	60	--	--	--	2200	Consol
18DD1	430	20	--	C	--	2600	NDGS
18DD2	285	85	--	C	Kh	2800	NDGS
20ACD	70	40	--	H	--	2840	Consol
20DAA	--	100	--	--	--	2620	Consol
27ADD	140	54	11/68	U	Qgo	1280	NDGS
28DCB	27	22	--	--	--	3000	Consol
32AD	400	12	--	H	--	2500	NDGS
32ADD	--	50	--	--	--	2300	Consol
144N85W							
10AAA	110	52	5/69	U	Qgo	1200	NDGS
10CCA	900	+97	5/68	S	Khg	2560	NDGS
11CCC	100	41	5/69	U	Qgo	2120	NDGS
12DDA1	--	--	--	--	--	820	Consol
12DDA2	--	--	--	--	--	640	Consol
12DDC	160	--	--	U	--	--	NDGS
14CBD	--	28	--	H	--	1600	Consol
15CCD	60	--	--	U	--	--	NDGS
36CD	56	--	--	U	--	--	NDGS

1/ Local Well Number: The 1st number denotes the township north of a base line, the 2nd number denotes the range west of the 5th P.M., and the 3rd number denotes the section in which the well is located. The 1st letter--A,B,C, or Ddesignates, respectively, the NE, NW, SW, and SE quarter section. Successive quarterings are denoted by the 2nd and 3rd letters. For example, well 1469914DAA is in the NE¼NE¼SE¼ of Sec. 15, T. 146 N., R. 90 W. Consecutive terminal numbers are added if more than one well is recorded within a 10 acre tract.

2/ Use: C, commercial; H, household; K, household and stock; S, stock; U, unused.

3/ Aquifer: Qgo, glacial outwash; Tt, Tongue River formation; Kh, Hell Creek-Ludlow formations (undifferentiated).

4/ Source of data: Consol, Consolidation Coal Company; NDGS, 1970 North Dakota Geological Survey, Bulletin 56, Part II.

SOURCE: Consolidation Coal Company and North Dakota Geological Survey 1970 Bulletin 56, Part II, data.

TABLE 2-16

CHEMICAL ANALYSES FROM WELLS AND TEST HOLES ADJACENT TO THE GLENHAROLD MINE

Local Well Number	Date of Coll.	Depth (ft)	Aquifer	Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Bicarbonate (HCO_3)	Total Alkalinity as $CaCO_3$	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved Solids (Calc) Residue	Sodium Adsorption Ratio	pH
143N85W															
04DAD2	2/18/76	50	--	.7	16	10	700	1007	825	700	5	7	2451c	34	7.6
144N84W															
18BCB	4/2/76	25	--	.12	116	50	270	947	776	298	15	11	1715c	5.3	7.7
18DBA	4/2/76	80	--	.22	4	2	770	1508	1784	30	50	19	2414c	80	8.5
18DD2	4/2/76	285	Kh	.04	4	2	780	1640	1376	165	50	27	2690c	81	8.4
20ACD	2/18/76	70	--	.20	40	18	800	1275	1045	830	5	10	2986c	26	7.6
20DDA	4/2/76	100	--	4.4	82	52	720	1303	1068	604	10	24	2808c	15	7.3
27ADD	10/23/68	140	Qgo	3.3	78	26	207	691	--	167	3.8	1.0	860R	5.2	7.9
28DBC	4/2/76	27	--	.10	96	0	760	1110	910	950	10	28	3039c	21	7.8
32ADD	4/2/76	50	--	.12	4	2	760	1571	1352	46	5	20	2444c	79	8.5
144N85W															
10AAA	5/13/69	110	Qgo	4.5	109	32	136	649	--	147	2.1	--	765R	2.9	7.8
10CCA	3/29/67	--	Khg	.10	4.4	.2	613	1100	--	2.1	275	--	1550R	77	8.5
11CCC	5/13/69	100	Qgo	25	339	81	98	660	--	807	--	2.5	1740R	1.2	7.3
12DDA1	4/2/76	--	--	.06	130	--	28	542	444	64	5	9	809c	.7	7.6
12DDA2	4/2/76	--	--	.06	112	30	24	473	388	55	5	9	705c	.5	7.6
14CBD	2/18/76	28	--	.20	210	66	30	628	515	85	150	290	1484c	.5	8.0

1/ Constituents in milligrams per litre.
2/ Aquifer: Qgo, glacial outwash; Kh, Hell creek-Ludlo formation (undifferentiated); Khf, Hell Creek-Fox Hills formation (undifferentiated)
3/ Dissolved solids: c, calculated; R, residue from evaporation at 180 degrees C.

SOURCE: Consolidation Coal Company and the North Dakota Geological Survey, 1970 Bulletin 56, Part II.

The ground water resources discussed previously in this chapter are the same for the short-term application area.

VEGETATION

Project Area

The Glenharold Mine project area lies in the mixed grass prairie region of the grassland biome (Weaver and Clements 1938). There are four major vegetation types within the project area, in addition to mined lands, and water surfaces. These four vegetation types include cropland, grassland, shrubland, and woodland. Croplands cover about 20% of the project area, with grasslands, shrublands and woodlands representing about 41%, 13%, and 13% respectively, mined lands 13% and water surfaces covering less than 1%. These major vegetation types, previously mined lands, and water surfaces are shown on Map 2-7. Acreages and percentage distribution for the project area are presented in Table 2-17.

The proposed mining areas represent about 23% of the project area. These areas are outlined on overlay No. 1. By using overlay No. 1 over Map 2-7, the geographic locations of the major vegetation types and water surfaces are depicted for the proposed mining areas. Acreages and percentage distribution are shown in Table 2-18 for the proposed mining areas.

Croplands

Wheat, domestic hay, oats, corn, barley, and flaxseed are the principal crops grown within the project area. Wheat and domestic hay are the two most abundant crops grown. Strip-cropping and summer fallowing are common farming practices. Production figures for crops within the project area are not known to exist, however, estimated production figures are given in Table 2-19. These estimates are based upon county averages as reported by the North Dakota Crop and Livestock Service.

The Fort Clark Irrigation District covers about 447 acres of cropland in the northeast corner of the project area. However, this area is not within the proposed mining areas. Horticulture is limited to home gardens and orchards for home use. No truck farming occurs within the project area.

Nationally designated prime farmlands and other lands of statewide significance are delineated and discussed in the soils section.

Native Prairies

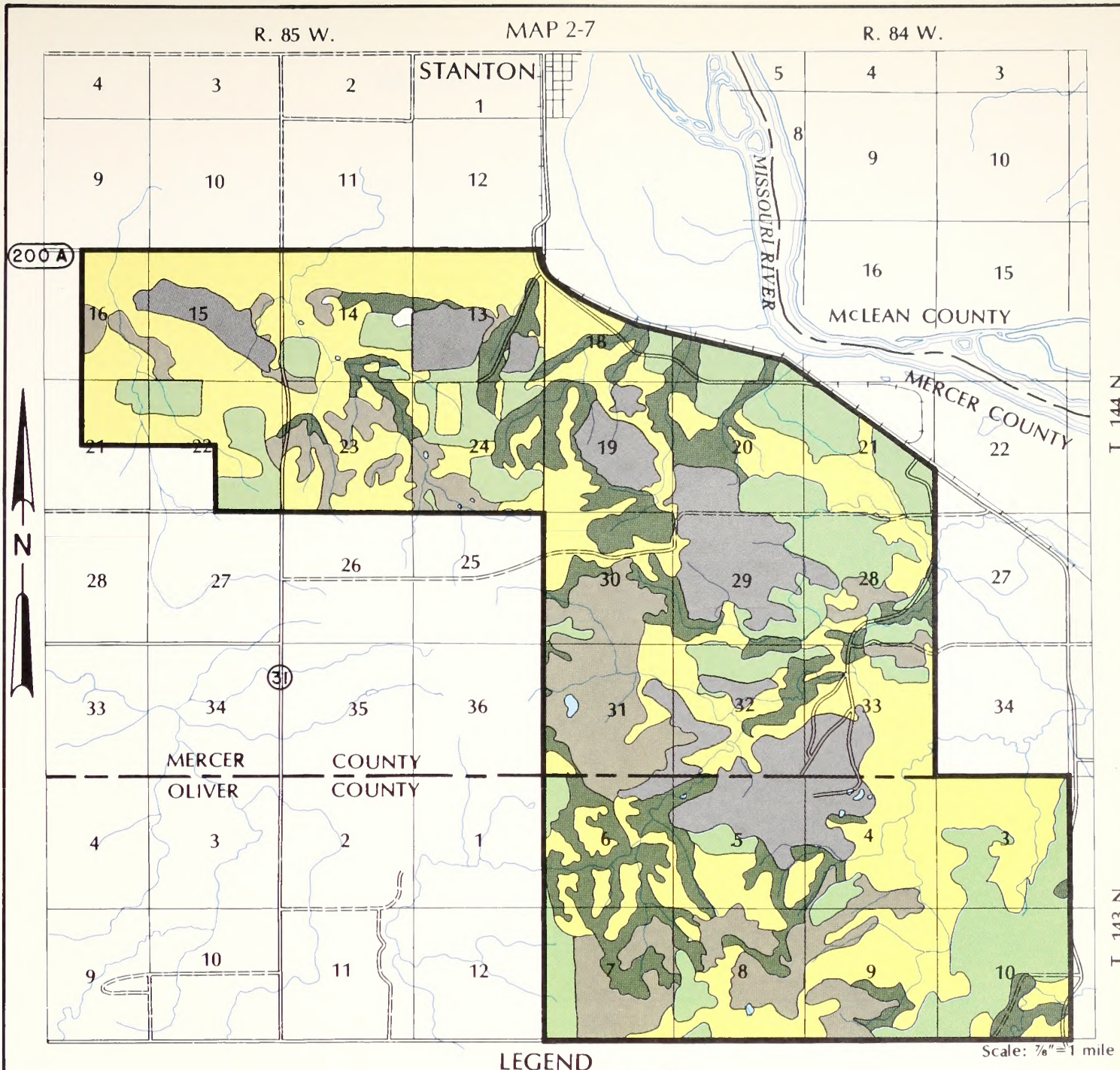
Native prairies are lands on which the native vegetation is predominantly grasses, grass-like plants, forbs, shrubs, or native woodlands suitable for grazing and browsing use. Species common to native grasslands include little bluestem (*Andropogon scoparius*), western wheatgrass (*Agropyron smithii*), needle-and-thread (*Stipa comata*), blue grama (*Bouteloua gracilis*), upland sedges (*Carex sp.*), and green needlegrass (*S. viridula*). Other species such as big bluestem (*A. gerardi*), prairie cordgrass (*Spartina pectinata*), and sloughsedge (*C. atherodes*) are common in small areas such as swales, seeps, and around small ponds.

The native prairie communities provide livestock grazing and wildlife habitat. Forage production varies with species composition, soil type, topography, and exposure. Recommended livestock stocking rates range from 2.5 to 5 acres/AUM depending upon overall range condition, soil type, and seasonal moisture levels. An animal unit month is the amount of forage required by a mature beef cow with calf at side for one month, or about 800 pounds of dry matter.

Native rangeland (or native prairie) is valued because of its ability to sustain grazing for the full grazing season. Native range, because of its greater species diversity, has greater wildlife and aesthetic value than reseeded grasslands. Figure 2-4 depicts typical native rangeland.

Shrublands, which range from a few square feet to several hundred acres, are scattered throughout the project area. Shrublands are depicted in Figure 2-5. Usually they are not pure stands of shrubs, but are interspersed with grasslands which are usually dominant. Dominant shrub species are buckbrush (*Symphoricarpos occidentalis*), western wild rose (*Rosa arkansana*), and buffaloberry (*Shepherdia argentea*). Other associated species include hawthorn (*Crataegus chrysocarpa*), chokecherry (*Prunus virginiana*), and native plum (*P. americana*). The shrublands are usually in slight depressions, along gullies, and on fringes of the woodland types.

Shrublands are used primarily in conjunction with the grassland for livestock grazing and wildlife habitat. Recommended stocking rates for shrublands are similar to and inclusive with the grassland ranges.



SOURCE: Bureau of Land Management 1977

MAJOR VEGETATION TYPES

TABLE 2-17

MAJOR VEGETATION TYPES
GLENHAROLD PROJECT AREA[1/]

Vegetation Type	Federal Subsurface Acres	Federal Subsurface Percent	Private and State Subsurface Acres	Private and State Subsurface Percent	Project Area Totals Acres	Project Area Totals Percent
Cropland	858	6	2,164	14	3,022	20
Grassland	2,074	14	4,092	27	6,167	41
Shrubland	675	4	1,322	9	1,997	13
Woodland	774	5	1,265	8	2,039	13
Water Surface	9	--	12	--	20	--
Mined	160	1	1,818	12	1,978	13
TOTALS	4,550	30	10,673	70	15,223	100

1/ Figures do not exclude residential, commercial, or industrial area, roads or major haul roads outside mined area.

2/ State owned subsurface: Grassland 258, Shrubland 51, Mined/Disturbed 171.

SOURCE: BLM and State of North Dakota 1977.

TABLE 2-18

MAJOR VEGETATION TYPES
GLENHAROLD PROPOSED MINING AREA

Vegetation Type	Federal Subsurface Acres[1/]	Federal Subsurface Percent	Private and State Subsurface Acres[2/]	Private and State Subsurface Percent	Proposed Mining Area Totals Acres	Proposed Mining Area Totals Percent
Cropland	296	8	367	10	663	19
Grassland	531	15	853	24	1,384	39
Shrubland	278	8	603	17	881	25
Woodland	278	8	334	10	612	17
Water Surface	2	--	5	--	7	--
TOTALS	1,385	39	2,162	61	3,547	100

Includes leased and unleased federal coal that would likely be mined.

1/ Figures do not exclude residential, commercial areas, or roads.

2/ Includes existing leases; croplands 30; grasslands 22; shrublands 36; and woodlands 23 acres.

2/ State owned subsurface: grassland, 23 acres

SOURCE: BLM and State of North Dakota 1977.

TABLE 2-19

ESTIMATED CROP PRODUCTION FIGURES

Crop	Acreage	Production/Acre	Total Production
Wheat	1,239	22.5 bu.	27,877 bu.
Domestic hay	1,058	1.75 T.	1,851 T.
Oats	423	40.6 bu.	17,173 bu.
Corn (silage)	157	6.6 T.	1,036 T.
Barley	85	31.7 bu.	2,694 bu.
Flaxseed	60	9.8 bu.	588 bu.

SOURCE: Calculated from North Dakota Crop and Livestock Statistics 1976.

TABLE 2-20

MAJOR VEGETATION TYPES
GLENHAROLD SHORT-TERM APPLICATION AREA

Vegetation Type	Proposed Mining Area		Unmined Application Areas		Total Short-Term Application Area	
	Acres	Percent	Acres	Percent	Acres	Percent
Cropland	266	16	120	7	386	23
Grassland	382	23	275	16	657	39
Shrubland	201	12	143	9	344	21
Woodland	132	8	147	9	279	17
Water Surface	2	--	0	0	2	--
TOTALS	982	59	685	41	1,668	100

SOURCE: BLM and Consolidation Coal Company Short-Term Application 1978.

Figure 2-4

Typical Mixed Grass Prairie

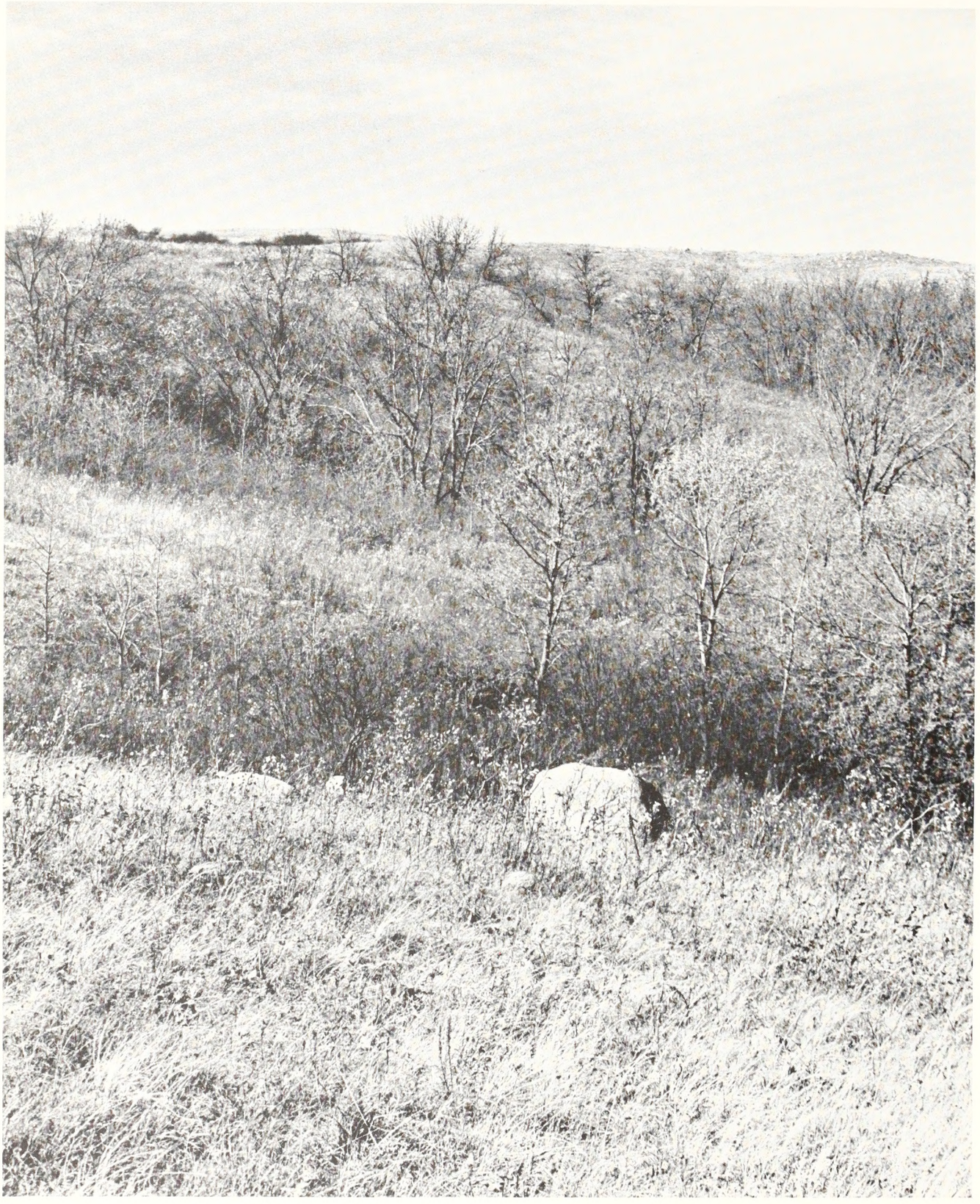
SOURCE: Bureau of Land Management 1976

Shrubland Type

Figure 2-5

SOURCE: North Dakota State University, Botany Department 1977

Figure 2-6



Typical Hardwood Draw

SOURCE: North Dakota Game and Fish Department 1977

Woodlands

Woodlands are generally on floodplains, along drainages, in large depressions, or on the sides of steep slopes or narrow ravines. Wooded stands are usually dominated by cottonwoods (*Poplus deltoides*) on the floodplains and by green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) on slopes or in draws. This latter type of woodland is also called "woody draws," "hardwood draws," or "ash coulees." An example is illustrated in Figure 2-6. The project area includes about 2,039 acres of native woodlands, about 612 acres of woodlands are within the proposed mining area.

Primary uses of woodlands include grazing and cover for wildlife. Woodland and shrubland in the project area are included in recommended stocking rates for grasslands as being part of the native prairie complex.

Water Surface

No areas are classified as wetlands under the existing vegetation types in the project area. There are 17 stock water ponds within the project area which total about 20 acres. All are intermittent except one, which covers approximately five acres. Peripheral vegetation consists of sedges, cattails, sloughgrass, and smartweed. It is assumed that communities of aquatic species exist in the ponds intermittently.

Mined and Other Disturbed Lands

Since mining operations began in 1965, about 1,978 acres have been mined. In addition, approximately 467 acres have been disturbed from associated mine operations and facilities. Therefore, the total disturbed area of the mine is about 2,445 acres or 16% of the project area. Prior to 1970, approximately 529 acres were mined which, by law, the company is not required to reclaim. However, the company has attempted to reclaim about 470 acres of these orphan spoils by reshaping and reseeding 355 acres to grasses.

Of the 2,445 mined and disturbed acres, there about 233 acres used for mine offices, shops, tipple, and major haul roads. The remaining 2,212 acres consist of about 529 acres mined prior to 1970, 1,449 acres mined since 1970, and 234 acres in associated mining disturbance such as soil storage areas and minor haul roads.

Reclamation

Reclamation of mined and other disturbed lands is in various stages. Of the total 2,445 acres of mined and disturbed lands, 1,236 acres are disturbed with no reclamation, 420 acres spoils are reshaped, 106 acres have been respread with topsoil, 532 acres have been reseeded or planted and 151 acres disturbed with no suitable plant growth material stripped.

At the present time, all reseedings have consisted of small grain crops (primarily wheat) or grass mixtures consisting of western wheatgrass, green needlegrass, slender wheatgrass (*A. carium*), little blue stem, sideoats grama, (*B. curtipendula*) and sweet clover (*Meliotus sp.*). This mixture is presently recommended by the Public Service Commission. Some tree and shrub species including green ash, American plum, chokecherry, and buffaloberry have been planted within the past three years in the form of shelterbelts.

The reclamation activities at the Glenharold Mine have generally been on an experimental basis. In 1976, Basin Electric Power Cooperative had a crop of wheat on reclaimed spoils at the Glenharold Mine. The crop yielded 16.8 bushels per acre and had a test weight of 56 pounds per bushel. It is estimated that the crop had a 10% hail loss without which the yield would have been about 18.5 bushels per acre. The average yield for the area on undisturbed land was 24 bushels per acre (Rude 1976). The land was reclaimed under the 1973 reclamation law under which was required replacement of up to two feet of topsoil on the leveled spoil.

Grass seeding mixtures have had varying degrees of success ranging from complete failures to extensively dense heavy stands in a three to five year period. Yields from rangelands grass reseedings range from 1,500 to 4,000 pounds of forage per acre in three to five years. Tree and shrub survival is averaging about 65 to 70%. To date, the Public Service Commission has not released any reclaimed land from bond for the Glenharold Mine.

Reclamation potential for the Glenharold Mine and surrounding area is rated by Packer 1974 as good to fairly good. Power et al. 1974 states that the productivity of mined lands can be restored in North Dakota, but qualifies this success on good reclamation planning, management, technique, and technology.

Rare and Endangered Species

No rare or endangered plant species listed on the federal registry of rare and endangered species has been located within the project area. However, North Dakota has a listing of plants considered rare or unique to the state (Barker et al. 1976). This list shows only one species, largeleaf pondwood (*Potamogon amplifolia*), as being unique and of occurrence in Oliver County, but suitable habitat is lacking and none are known to occur in the project area.

Future Trends

Mining would continue as part of the existing environment until at least 1995, with about 115 acres mined and approximately 211 acres disturbed per year.

Grazing and farming would probably continue much in the same manner as today with crop and livestock operations governed in part by climatic fluctuations and the market pricing structure. Irrigation might occur in the northeastern portion of the project area where 582 acres lie within the Fort Clark Irrigation District.

Some hardwood draw type woodlands in the project area might decline in productivity due to the heavy grazing of cattle which has occurred in recent years and which would be expected to continue in the future.

Short-Term Application Area

The short-term application area is included in the discussion of the project area and proposed mining areas of the above section. The short-term application area represents 1,668 acres or 11% of the project area and about 983 acres or 28% of the total proposed mining area. These figures leave about 685 acres or 41% of the short-term application area unmined as shown in Table 2-20 and Map 2-7 with overlay No. 1.

ANIMALS

Project Area

Although wildlife populations on the project area and in the vicinity are significantly reduced from historic levels (Robinson 1966 and Stewart 1975), the interspersion of habitat types, particularly woody draws and shrublands, in the breaks type terrain that dominates most of the project area is of relatively high value for wildlife compared to most habitats in west central North Dakota. The primary game species on the area are sharp-tailed grouse and white-tailed deer. However, many other game and non-game species of wildlife are present. Waterfowl habitat is limited to scattered, mostly man-made, ponds. Although the project area is within the general range of several endangered species, it is unlikely that any endangered species actually occurs on or utilizes the project area. Cattle are the most common domestic animal on the project area, about 67% of which is rangeland.

Future trends in wildlife population numbers, and in habitat quantity and quality on the project area without the proposed action, are expected to be stable or decline slightly. Mining and more intensive agricultural practices will continue the reduction of, or change in, wildlife habitats. Where these and other activities reduce the acreage of hardwood or brushy draws, impacts to the many species that depend on these habitats could be significant. Certain non-game species, especially songbirds tolerant of man's presence, can be expected to increase slightly. Population of most game species, however, will remain stable or decline slightly. Domestic animal numbers can be expected to fluctuate widely with market conditions and availability of forage.

Domestic Animals

Cattle are the most important domestic animal in the project area. Other major market animals are sheep, hogs, and, to some extent, chickens and horses. (See Appendix 2, Table 1 for county livestock populations.)

Approximately 67% of the project area (10,200 acres) is rangeland which is defined as grassland, shrubland, and woodland (see Table 2-17). In this area, from 1.4 to 5 acres are required to support one animal unit month depending upon soil type and range condition (Galt 1977, personal communi-

cation). An animal unit month is the acreage required to support one cow and her calf for one month.

Domestic pasture and hayland occupy an estimated 1,058 acres of the project area. Annual hay production on this land ranges from about one-half to one ton per acre.

Anthrax has not been reported in Mercer and Oliver Counties for 34 years (Flagg 1976, personal communication). Blackleg and malignant edema are endemic in cattle and sheep in the two counties, meaning they occur each year but at a very low level because of extensive immunization. Although outbreaks of these diseases are often associated with soil disturbances that resurface viable spores, no outbreaks have been associated with ongoing mining and farming operations in the project area (Hastings 1976, personal communication).

Big Game and Upland Game Birds

Being within the Missouri River breaks, the project area has a relatively high population of white-tailed deer (Trego 1976, unpublished), with densities of approximately five animals per square mile (Table 3-3 in Chapter 3). Because white-tailed deer are not highly dependent upon rough terrain, they are likely to be found throughout the project area wherever sufficient woody or shrub cover is available. No specific harvest or man-day use figures are available for the project area.

Mule deer, although not as numerous as white-tailed deer, are infrequently seen in the breaks adjacent to the Missouri River (Figure 2-7). Various shrub species and rough terrain are particularly important habitat components for mule deer. The population of mule deer in the Glenharold Mine project area is relatively low (Trego 1975, unpublished) with animal densities well under 0.5 per square mile. No specific harvest or man-day use figures are available for the Glenharold Mine project area.

The antelope population on and adjacent to the Glenharold Mine project area is low (Trego 1975, unpublished), with densities of about 0.05 per square mile.

The sharp-tailed grouse is North Dakota's most important upland game bird. Population levels are considered to be "low" to "medium" in Oliver and Mercer Counties (Trego 1975, unpublished). Local population vigor and numbers are, however, directly related to habitat. the interspersion of grassland, shrubland, and woodland on the project area provides above average habitat for these birds. The spring sharptail population of the project area is estimated to be about eight birds per square mile (Trego 1976, unpublished).

Pheasants in North Dakota require dense undisturbed brush and grass cover for nesting, rearing broods, and, even more importantly, surviving rigorous winter weather. When such cover is adjacent to grain crops, conditions for pheasants are usually ideal. Habitat within the project area is considered fair to good and population densities low to medium; the spring population amounts to about ten birds per square mile (Trego 1975, unpublished).

Habitat requirements of Hungarian partridge are similar to those of pheasants. Although the Hungarian partridge is considered more adaptable than the pheasant to North Dakota's harsh winters, their population level in the project area is low, probably amounting to about six birds per square mile in the spring (Trego 1976, personal communication).

Due to the proximity of the Missouri River bottomlands, wild turkeys may occasionally visit the project area. Their density on the project area is estimated to be low to medium, perhaps one bird per square mile (Kruckenberg 1976, personal communication).

Waterfowl and Shorebirds

There is very little waterfowl habitat on the project area. Aerial photographs taken during August 1975 and May 1978 (higher than normal rainfall years) revealed no discernible surface water with the following exceptions: T. 143 N., R. 84 W., a dugout and stock water pond in Section 3, two small wet areas in Section 7, a stock pond in Section 8, and three acre type 2 natural wetland (Shaw and Fredine 1956) in Section 10; T. 144 N., R. 84 W., a small stock pond in Section 20, and a five-acre and a three-acre stock pond in Section 31; T. 144 N., R. 85 W., a small stock pond in Section 16, and two small stock ponds in a coulee in Section 24.

There are no permanent natural wetlands (type III, IV, or V wetlands of Shaw and Fredine 1956) within the project area, but field examination indicated some surface water sites are directly attributable to strip mine activity. Such sites are either shallow depressions or deep, steep-sided trenches and are generally unattractive to waterfowl and shorebirds because of lack of aquatic vegetation and the high degree of disturbance they receive.

Because of the extremely limited habitat, waterfowl and shorebird breeding and migration use of

Figure 2-7

Mule Deer. Although not as numerous as white-tailed deer, mule deer do occur on the project area.

SOURCE: North Dakota Game and Fish Department

Raccoon. Mink and raccoons are probably numerous in the project area because the wooded coulees, springs, and intermittent streams they require are common.

Figure 2-8

SOURCE: North Dakota Game and Fish Department

the project area is minimal. No field surveys of waterfowl use of the area have been made. However, because of the proximity of the Missouri River, it is likely that a large variety of waterfowl migrate over the project area. Common species likely to use the area at least occasionally include: gadwall, blue-wing teal, mallard, shoveller, lesser scaup, pied-bill grebe, American coot, great blue heron, killdeer, common snipe, and willett (Nelson 1976, personal communication).

Furbearers

Because there are no large (greater than 0.5 acre) permanent natural wetlands on the project area, it is unlikely that beavers and muskrats are numerous. Mink and raccoons are expected to be numerous in the project area because the wooded coulees, pools, springs, and intermittent streams they require are common (Kruckenberg 1976, personal communication). Badgers, red foxes, bobcats, striped skunks, coyotes, least weasels, short-tailed and long-tailed weasels, and jackrabbits all utilize the basic habitats in the project area - grassland, woodland, shrubland, agricultural land, and wetland. No data on population levels or trends are available.

Small Mammals

On-site studies of small mammals have not been made; however, the presence of many species can be inferred from information available about their dependence on and use of the habitat types that occur on the site (Appendix 2, Table 2).

The native grasslands and shrublands which comprise a large portion of the project area probably support an abundant small mammal population. Small animals are staple food for predators. Based on trapping done at the ANG Coal Gasification Plant project site near Beulah (Woodward-Clyde Consultants 1975), the most common small mammals on the project area are thirteen-lined ground squirrels and deer mice.

Raptors

The interspersion of grassland, cropland, and native woodlands within the project area makes it generally good raptor habitat.

Although no eagles are known to have nested on the area, bald and golden eagles do use the area occasionally.

Stewart (1975) records the following owls as breeding on or in the vicinity of the project area: screech owl, great-horned owl, burrowing owl, long-eared owl, and short-eared owl. In addition, the snowy owl is a common winter visitor (Kruckenberg 1976, personal communication).

Stewart (1975) provides the following breeding records during the period 1950-1972 in the project area: sharp-shinned hawk, Cooper's hawk, Swainson's hawk, American kestrel, red-tailed hawk, and ferruginous hawk. Other non-breeding hawk observations indicate the rough-legged hawk is a common winter visitor (Randall 1976, personal communication). Randall also reports observations in the vicinity of the goshawk and broad-winged hawk. Hibbard (1972) reports the prairie falcon also occurs near this area.

Other Non-Game Birds

A large variety of non-game birds use the habitats found on the project area (Appendix 2, Table 3). The hardwood and brushy draws are particularly beneficial to non-game birds. Although they were not inventoried on the site, it is reasonable to assume that all of the species listed utilize habitats on the project area.

Some non-game birds have partially adapted to more artificial, mono-culture type habitats and can produce serious damage to agricultural crops. Other birds benefit agriculture by consuming insect pests. Many non-game birds also are important links in numerous food chains. These birds have a high aesthetic value, as many people enjoy seeing a variety of birds.

Reptiles and Amphibians

The six amphibians and eight reptiles likely to occur in the project area are listed in Appendix 2, Table 4. These include one species salamander, three species of toads, two kinds of frogs, one turtle, and seven species of snakes. Population and trend data for these species are not available.

Figure 2-9

Yellow-bellied Racers. One of six species of snakes that probably occur on the project area, the yellow-bellied racer uses woodland, grassland, and cropland habitats.

SOURCE: North Dakota Game and Fish Department

Fish

No fish are known to occupy the limited aquatic habitat on the project area. Intermittent streams in the project area drain toward the lower Knife River five miles to the north and the Missouri River three miles to the northeast. Both the Knife and Missouri Rivers support good sport fisheries (Comita and Whitman 1976; Woodward-Clyde Consultants 1975); the Missouri receives runoff from drainages in the project area. Fish in order of importance in the Knife and Missouri Rivers include channel catfish, walleye, sauger, northern pike, white bass, black bullhead, stonecat, yellow perch, and minnows.

Invertebrates

Many aquatic and terrestrial invertebrate species occur on the project area. Habitat for aquatic micro- and macro-invertebrates is limited, however. Species likely to live in the stock ponds on the project area include freshwater shrimp, rotifers, protozoa, roundworms, earthworms, mayflies, dragonflies, predacious diving beetles, and many species of flies. Woodward-Clyde Consultants (1975) list 28 groups of zooplankton and 102 groups of phytoplankton in similar aquatic habitats 20 miles west of the project area.

Little information is available concerning numbers or species of terrestrial insects, including soil organisms on the project area. However, it can be assumed that many species of terrestrial insects occur on the area and provide needed food for the wide variety of birds, rodents, and some mammals.

Threatened and Endangered Species

The whooping crane, bald eagle, Arctic peregrine falcon, and American peregrine falcon are endangered birds that could reasonably be expected to be observed on or over the project area.

The project area appears to contain no habitat that could be classed as attractive to any of the above birds. Only the bald eagle has been recorded as nesting in North Dakota in recent years: a bald eagle nesting site about five miles east of the project area, in a big cottonwood along the Missouri (Bry 1975).

The range of the endangered swift (or kit) fox and black-footed ferret includes the project area. A swift fox was apparently observed in 1976 in Mercer County about a mile south of Hazen and seven miles west of the project area (Seabloom et al. 1978); however, "it is so rare that its present distribution is indeterminate" (Seabloom et al. 1978). A ferret has not been observed in the area of Stanton since 1915 (see Final Supplement to Regional Study). Prairie dog towns are important habitat components for the swift fox and the black-footed ferret. The closest prairie dog town is about 20 miles to the east in Mercer County. Thus, neither a ferret nor a swift fox could reasonably be expected to be observed on the project area.

In addition to the federally listed species discussed above, the state of North Dakota lists the wolverine, otter, pine marten, and fisher as "protected furbearers." They are rare in North Dakota, even though they may be well established elsewhere. There is no record of these animals occurring on the project area, although they may occur along the Missouri River (in the case of the otter) and in the Missouri River breaks.

Short-Term Application Area

Wildlfe populations on the short-term area are similar to those described above for the project area as a whole. Since the short-term area contains an even higher percentage of woodland than the project area (17% compared to 13% as shown in Tables 2-20 and 2-17), the area is particularly valuable for white-tailed deer, sharp-tailed grouse, and many other species. Of the short-term application area, only Section 25 in T. 144 N., R. 85 W., has discernible surface water (two small stock water ponds) which may be of value to waterfowl. Thus, the short-term area is of even less value to waterfowl and shorebirds than is the project area in general.

Endangered species that could reasonably be expected to be observed on the short-term application area include the whooping crane, bald eagle, Arctic peregrine falcon, American peregrine falcon, the black-footed ferret, and the kit fox. However, there is no evidence that any of these species utilize either the short-term area or the project area. The only state listed endangered species is the black-footed ferret.

There are no known bald or golden eagle nests or concentration areas and no known falcon cliff nesting sites or active nests within the short-term or project areas. A raptor nest survey should be conducted on the project area in order to determine their absence or presence.

It has not been determined if there is high priority habitat for migratory birds of high federal interest on the short-term application area. The BLM and the U.S. Fish and Wildlife Service will continue to coordinate in order to determine the extent of this possible impact prior to leasing.

The situation for domestic animals on the short-term application area is basically the same as on the project area. Approximately 77.8% of the short-term area is rangeland or native prairie (Table 2-20).

PREHISTORIC AND HISTORIC FEATURES

Project Area

The cultural environment, containing sites and features of prehistoric or historic significance, can only be defined adequately from systematic literature search and on-the-ground inventory. Human use of the environment during prehistoric times can only be located by on-the-ground inventory. Even with written history, not all features were recorded adequately in historical documents.

Much of the area within the project boundaries has received a thorough on-the-ground inventory and literature survey. This work was carried out in 1974, 1976, 1977 and 1978 by Chris L. Dill and Nick Franke of the State Historical Society of North Dakota for Mercer County portions of the project area, and in 1978 by T.R. Farmer and J.G. Franzen of Commonwealth Associates Inc. for Oliver County portions. However, some of the area within the project boundaries, including areas identified by Consol as strippable in their December 31, 1978, Glenharold Mine Plan, has not been inventoried. This includes 280 acres of federal coal lands (Map 2-8).

Prehistoric Features

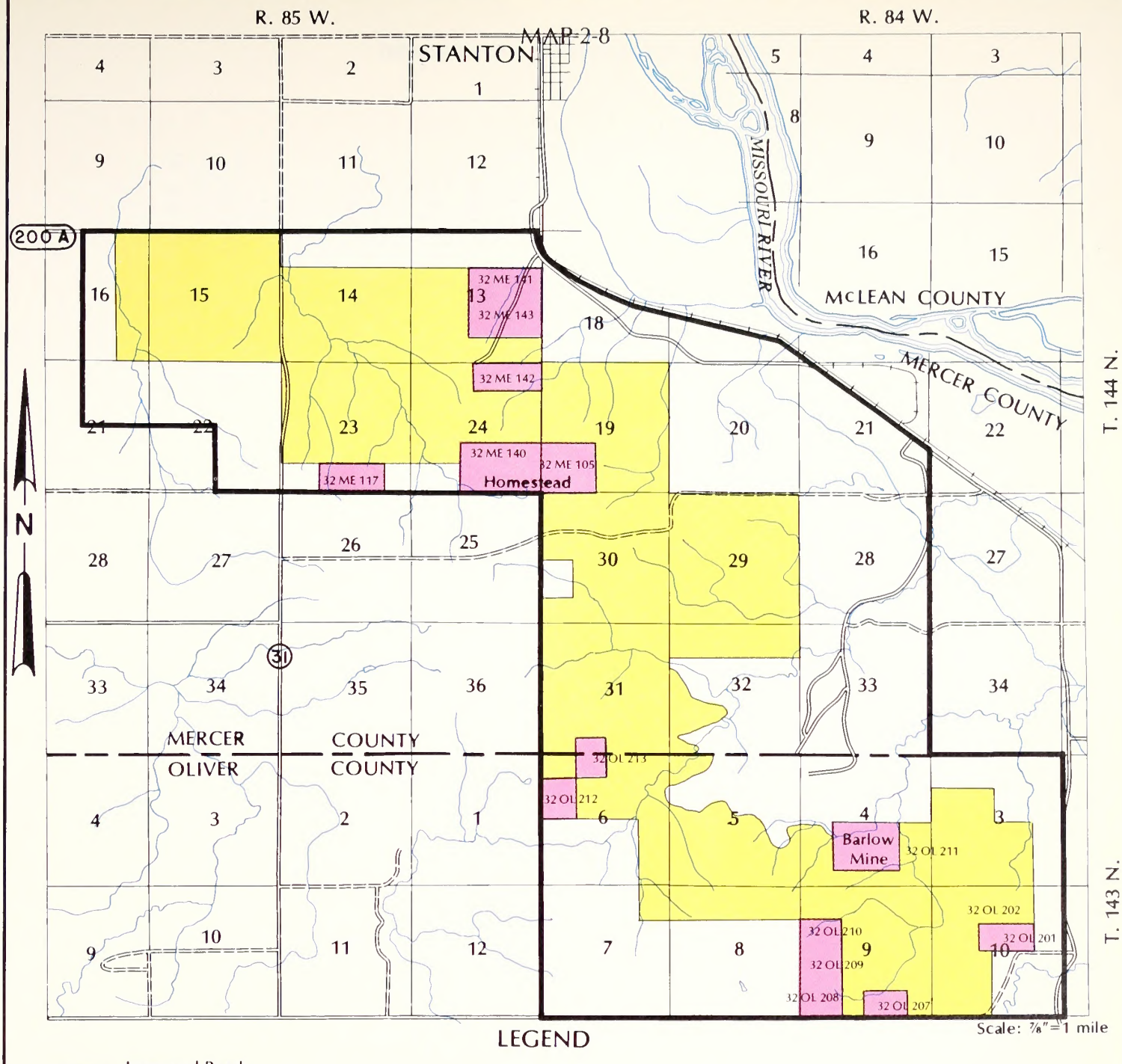
Seven prehistoric sites were located within the boundary of the project area as a result of systematic inventory. In addition, one site has been reported in the State Historical Society's files from other than systematic inventory data. Four additional sites were found within one mile of the project boundary (32-OL-205, 32-OL-206, 32-ME-106, 32-ME-118). Three prehistoric sites, 32-OL-209, 32-OL-210 and 32-OL-213, are within the area identified as minable in the Glenharold mining plan. None of these identified sites occur over federal coal. (See Map 2-8.)

The sites fall into three functional categories. Two sites are linear mounds (32-ME-105, 32-ME-106), three sites are lithic scatters (32-OL-206, 32-OL-212, 32-OL-213) and seven sites are stone circles (32-OL-207, 32-OL-208, 32-OL-209, 32-OL-210, 32-OL-205, 32-ME-117, 32-ME-118). (See Table 2-21.)

The stone circle sites are possibly the remains of anchor stones which held down the edges of skin tents or tipis. No cultural material was collected from these stone circle sites and no testing or excavation has yet been conducted. Therefore, the interpretation of these sites remains only an educated guess. Elsewhere in the Northwestern Plains, stone circles have been associated with two of the three major cultural periods on the Plains, Archaic or Forager dating from 4000 B.C. to A.D. 500, and the Late Prehistoric Period dating from A.D. 500 to approximately 1800. It is not known where the Glenharold stone circles fall into that cultural continuum.

Lithic scatter sites consist of lithic debris from tool manufacture and use, worked lithic material and artifacts. While other features may also be present, the function of such a site may not always be determined, and so these sites are labeled lithic scatters. None of the Glenharold lithic scatter sites were tested, though collections were made from each site. Knife River Flint predominated as the material at the sites. An end scraper, side scraper, several bifaces and a large side-notched projectile point were collected from 32-OL-212. This projectile point would seem to indicate an Archaic period date for this site, and the nature and number of flakes present may indicate a type of lithic processing area. Lithic scatter sites occur in all temporal and cultural periods that have been identified during prehistoric human occupation of the Plains, and at present, sites 32-OL-206 and 32-OL-213 have not been dated.

Artifacts and bone material have been collected from the two mound sites, which are linear arrangements of mounded earth. Although the artifacts and bone material have not been systematically studied, one bone fragment has been identified as a portion of a human skull. Neither site has been tested or excavated, nor have any other mound sites been so studied from adjacent areas of North Dakota. Farther east in the United States, similar mounds served as human burial places and have been associated with the Woodland Period, which overlaps both the Archaic and Late Prehistoric Periods. Their presence in North Dakota, however, remains enig-



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Area of Intensive CR Inventory
- 32 ME 118 Prehistoric and Historic Site Areas

SOURCE: State Historical Society of North Dakota Files

PREHISTORIC AND HISTORIC SITES

TABLE 2-21

PREHISTORIC SITES

Site No.	Site Type	Legal Description	Mineral Ownership	NRHP Status	In/Out of Strippable Coal Area	In/Out of Project Boundary
32-ME-105	Linear Mounds	T144N R84W Sec. 19	Private	Qualified & Potentially Eligible	Out	In
32-ME-106	Linear Mounds	T144N R85W Sec. 24	Federal	Qualified & Potentially Eligible	Out	Out
32-ME-117	Stone Circle	T144N R85W Sec. 23	Private		Out	In
32-ME-118	Stone Circle	T144N R85W Sec. 25	Private		Out	Out
32-OL-205	Stone Circle	T143N R84W Sec. 17	Private	Potentially Eligible	Out	Out
32-OL-206	Lithic Scatter	T143N R84W Sec. 16	Private		Out	Out
32-OL-207	Stone Circle	T143N R84W Sec. 9	Private	Potentially Eligible	Out	In
32-OL-208	Stone Circle	T143N R84W Sec. 9	Private	Potentially Eligible	Out	In
32-OL-209	Stone Circle	T143N R84W Sec. 9	Private	Potentially Eligible	In	In
32-OL-210	Stone Circle	T143N R84W Sec. 9	Private	Potentially Eligible	In	In
32-OL-212	Lithic Scatter	T143N R84W Sec. 6	Federal	Potentially Eligible	Out	In
32-OL-213	Lithic Scatter and Homestead	T143N R84W Sec. 6	Private		In	In

SOURCE: Bureau of Land Management 1979.

TABLE 2-22

HISTORIC SITES

Site No.	Site Type	Legal Description	Mineral Ownership	NRHP Status	In/Out of Strippable Coal Area	In/Out of Project Boundary
32-ME-140	Historic Graves	T144N R85W Sec. 24	Federal		Out	In
32-ME-141	Serr Mine	T144N R85W Sec. 13	Private	Destroyed Partially	In	In
32-ME-142	Teuber Mine	T144N R85W Sec. 24	Federal		In	In
32-ME-143	Stanton Coal Mine Co.	R144N R85W Sec. 13	Private	Disturbed	Out	In
32-OL-201	Bagley Homestead	T144N R84W Sec. 10	Private		Out	In
32-OL-202	Bagley Cemetery	T144N R84W Sec. 10	Private		Out	In
32-OL-211	Herrick Homestead	T144N R84W Sec. 4	Federal		In	In
32-OL-213	Homestead and Lithic Scatter	T144N R84W Sec. 6	Private		In	In
	Barlow Mine	T144N R84W Sec. 4	Federal/Private		?	In
	Teuber Homestead	T144N R85W Sec. 24	Federal		?	In

SOURCE: Bureau of Land Management 1979.

matic, since two other cultures were present in and around the Missouri Valley at approximately the same time. Plains Nomadic peoples were bison hunters on the prairies west of the Missouri, and earthlodge village people belonging to the Plains Village Cultural Tradition farmed along the Missouri flood plain. People belonging to the Plains Woodland Culture possibly built the linear mounds at approximately the same time. These two sites (32-ME-105, 32-ME-106) are important in possible interpretation of this zone of culture contact. They are rare site types for the west side of the Missouri.

Historic Features

Eight historical sites have been located in the project area (Map 2-8) from systematic inventory. Four of these sites occur over the identified strippable coal. Four sites occur over federal coal (32-ME-140, 32-ME-142, 32-OL-211, Teuber Homestead) though only two of those federal coal tracts have been applied for to lease. Two additional sites have been reported from inside the project area, based on data obtained by means other than systematic inventory (Table 2-22). At this time, none of the historical sites are identified as being eligible for the National Register of Historic Places. However, further research into the background of homesteads in the project area may reveal the presence of such sites. Other historical sites possibly lie within the project area but outside of that part which has received systematic inventory.

The historic sites also fall into three functional categories. These include grave and cemetery sites (32-ME-140, 32-OL-202), historic coal mines (32-ME-141, 32-ME-142, 32-ME-143, and the Barlow Mine) and homesteads (32-OL-201, 32-OL-211, 32-OL-213, and the Teuber homestead.)

Both grave/cemetery sites were located by systematic inventory. Indicated by two six-foot-long depressions, 32-ME-140 consists of at least two burials. Although the immediate surroundings of the burials have been cultivated, the farmer has avoided the actual burial sites. Local informants who are decendents of one of the deceased report that one of the graves is that of William John Brown, who died in April, 1907. The other depression may represent several graves. Local informants believe that several children belonging to a family named Nyman are buried at this locality. The family reportedly later moved to Pennsylvania, from where they originated. This grave post-dates 1885.

The Bagley cemetery is a small, fenced cemetery containing about 20 graves. This cemetery is still in use. The earliest grave is dated 1898 while the latest is 1977.

Four historic underground coal mines have been identified within the project area. Three of these mines lie in close association in Section 13 and 24, T. 144 N., R. 85 W. The Serr Mine, a drift-type mine, was opened in 1923, by A.G. Serr and operated between 1923 and 1927. Strip mine activities by Consolidated Coal Company exposed portions of the Serr Mine tunnels in 1976 and 1977. Photographic records were made and some mining artifacts and equipment were recovered at that time, by State Historical Society personnel, and by Consolidation Coal Company.

The Teuber Mine, a shaft-type mine, consists of foundations, equipment and a basement. This mine operated from 1927 until 1944 under the ownership of John Teuber.

The Stanton Coal Mining Company site (32-ME-143) consists of a mine head and subsidence areas as the remnants of a drift-type mine, though an abandoned strip mined area nearby appears also to be part of this site. The mine operated between 1931 and 1943 under several superintendents and by two shafts, the original Amos N' Andy Mine shaft (1931-1935) and the later Stanton Mine shaft (1935-1943). Some other Stanton Coal Mining Company features may be in the area. Site 32-ME-143 has been disturbed by Consol's present mining activities.

The State Engineer's Report for 1916-1918 indicate the location of the Barlow Coal Mine. However, no further details concerning this mine are known at the present time.

Four homestead sites have also been recorded within the project area. Site 32-OL-201 consists of the original Bagley homestead cabin, built in the late 1880's. The cabin has been moved from its original location and modifications and additions have been made to its construction and interior. The Herrick homestead, 32-OL-211, was built in 1908 by the Herrick family, and sold in 1912. At that time, the structures were dismantled and the timbers removed, so that at present, only the foundations for three structures remain. Site 32-OL-213 is a two component site consisting of a prehistoric lithic scatter and a historic house depression and debris scatter. No details have been recorded about the historic component of the site beyond a brief description. A homestead apparently belonging to John Teuber, operator of the Teuber Mine, is located in Section 24, T. 144 N., R. 85 W. Remains consist only of concrete foundations. The exact age of the structure is not known.

Related Prehistoric and Historic Features

The free-flowing stretch of the Missouri River between Garrison Dam and the upper end of Oahe Reservoir contains much of the remaining evidence of late prehistoric and early historic activity along the Missouri River in central North Dakota. The Glenharold Mine is visible to a good stretch of this adjacent Missouri River bottomland which contains significant prehistoric and historic features. This includes five prehistoric earthlodge villages that are in sections bordoring the project area: the Lyman Alderin site (32-ME-3), the Alderin Creek site (32-ME-4), the Deapolis site (32-DE-5), the Boller site (32-ME-6) and the White Buffalo Robe site (32-ME-7). In addition, six prehistoric/historic Indian village sites view the mining area: Fort Clark (32-ME-2), Sakakawea (32-ME-11), Lower Hidatsa (32-ME-10), Big Hidatsa (32-ME-12), Buchfink (32-ME-4), and Amahami Village (32-ME-8). Amahami Village has been largely destroyed by recent gravel quarrying. Fort Clark is protected and administered by the State Historical Society of North Dakota (SHSND); the other four prehistoric/historic Indian sites are administered by the National Park Service as the Knife River Indian Villages National Historic Site. Big Hidatsa Village site has been listed on the National Register of Historic Places since October 15, 1966.

Early historic Euro-American exploration and fur trade activities are also well represented by sites along this stretch of the Missouri. Three Lewis and Clark temporary campsites, and the vicinity of the Lewis and Clark Expeditions' 1804-05 winter quarters, Fort Mandan lie between Stanton and Fort Clark. Fort Clark itself was an early fur trade and Indian post. The Fort Mandan commemorative site is actually 10 miles distant from the original winter quarters site, which has been eroded away by the Missouri River. Both Fort Mandan and Fort Clark are administered and protected as state historic sites by the SHSND.

National Register of Historic Places

The February 6, 1979 National Register of Historic Places Annual Listing of Properties and the State Historic Preservation Office were consulted. No sites in or immediately adjacent to the project area have presently been listed on or determined eligible to the National Register. However, the two prehistoric linear mounds, 32-ME-105 and 32-ME-106, qualify for the National Register of Historic Places, on the basis of their possible contribution to the knowledge of the western distribution and nature of such sites and due to their rarity on the west side of the Missouri River. The Oliver County stone circle sites and 32-OL-212 may be eligible for the National Register, but further evaluative work will be necessary to determine these sites' status.

Within the visual environment of the project area, only the Big Hidatsa Village site is presently on the Register. This site, along with Sakakawea, Buchfink, and Lower Hidatsa, have been made part of the Knife River Villages National Historic Site, administered by the National Park Service.

Short-Term Application Area

The majority of the federal coal tracts applied for in the short-term lease have been inventoried for Cultural Resources at this time. Inventoried tracts include: T. 144 N., R. 84 W., Section 30, SE1/4, S1/2SW1/4, NE1/4SW1/4, and Section 32, N1/2N1/2; and T. 144 N., R. 85 W., Section 14, S1/2, S1/2N1/2, and Section 24, N1/2, N1/2 S1/2.

These inventories were conducted between 1974 and 1978 by Chris Dill and Nick Franke of the State Historical Society of North Dakota. As a result of this inventory work, no prehistoric sites and two historic sites were located overlying the short-term area. These include 32-ME-140, a historic burial site previously discussed and 32-ME-142, the Teuber Mine, also previously discussed. Neither site is eligible for the National Register of Historic Places.

Approximately 280 acres of the short-term area have not been inventoried for cultural features. This includes: T. 144 N., R. 84 W., Section 18, SW1/4 SW1/4, Section 20, SW1/4E1/4, and Section 30, NW1/4SW1/4; and T. 144 N., R. 85 W., Section 22, N1/2NE1/4, and Section 24, S1/2SW1/4.

At present, due to this lack of inventory data, it is not possible to entirely state the presence or absence of cultural features on those tracts. However, the Teuber Homestead is recorded as existing in the south half of Section 24, T. 144 N., R. 85 W., from other than systematic inventory data.

Subsurface, previously undiscovered sites, may be exposed during mining operations on any of the short-term application area. Evaluation of any sites thus located must take place upon their discovery.

AESTHETICS

Project Area

Aesthetics is the science of beauty and human values. It deals with how man perceives the environment through his senses of sight, hearing, smell, taste, and touch. The emphasis of this section is placed on the visual (sense of sight), sound (hearing), and odors (smell) aspects of aesthetics.

Visual Resource

The scenery for the Glenharold Mine project area can be divided into three major units. These are the plains, the Missouri River area, and breaks topography (Map 2-9). The plains landscape is characterized by flat to undulating hills (Figure 2-10). Native grassland and croplands interweave to form a rectilinear patchwork pattern on the landscape. Two of the more scenic areas in North Dakota are the Missouri River and the breaks topography. The Missouri River is located to the northeast of the project area. The Missouri River valley features the riverine environment with hardwood vegetation of cottonwood and willow with some ash, elm, and boxelder (Figure 2-11). The breaks topography lies above the Missouri River valley. This area is typified by dissected, rough eroded buttes and bluffs.

Each scenery unit was evaluated to determine scenic quality. The scenic quality rating for each scenery unit is assigned as A, B, or C, or as excellent, good, or average, respectively. The methodology for determining the scenic quality is described in Appendix 2, Figure 1. The results of the ratings were as follows:

Plains - C, Average

Missouri River - A, Excellent

Breaks Topography - B, Good

Visual intrusions are man-introduced features such as changes in the land surface, vegetation, or structures which are generally incongruous or out of context with the natural landscape character. In the Glenharold Mine area, a number of intrusions have been caused by past and ongoing mining operations. These are the existing mine spoil piles, power lines, current mining, the operational area, and buildings (see Map 2-9 and Figures 2-12 to 2-16). Trucks, heavy equipment, and the dragline on the skyline reduce visual quality. Spoil piles change the landform and temporarily change the skyline with peaked ridges. A more expanded discussion of these intrusions can be found in Appendix 2, Figure 1.

A second measurement of the visual environment is human response values, which are divided into measurements of "visual sensitivity" and "visual zones."

The visual sensitivity level is a qualitative measurement of importance of the human response to the visual environment within the area. Areas have been rated as high, medium, or low sensitivity. In the project area, the high and low levels of sensitivity have been identified on Map 2-10 as follows:

Areas within the visual corridor of State Highways 200A, 31, and 48--High

Areas outside the visual corridor of major highways--Low

The analysis and the criteria on the sensitivity levels used can be found in Appendix 2, Figure 1.

Two visual zones seen by users of the major travel routes are the foreground-middleground zone and the seldom seen zone. The foregound-middleground zone is visible from a travel route or use area to a distance of three to five miles. The seldom seen zone is seen from low-use transportation routes or is more than five miles from the viewer.

The visual zones were mapped in the Glenharold area (Map 2-10). The visual zones are related to the visual sensitivity areas as follows:

Area within the visual corridors of State Highways 200A, 31, and 48--Foreground-middleground

Area outside the visual corridor of major highways--Seldom seen

The two measurements of visual values (the scenic quality and the human responses) were analyzed in Appendix 2, Figure 1 and converted into visual resource management classes on Map 2-11. The classes describe the degree of visual alteration that is acceptable according to Bureau of Land Management standards within the characteristic landscape. Definitions of the five classes are:

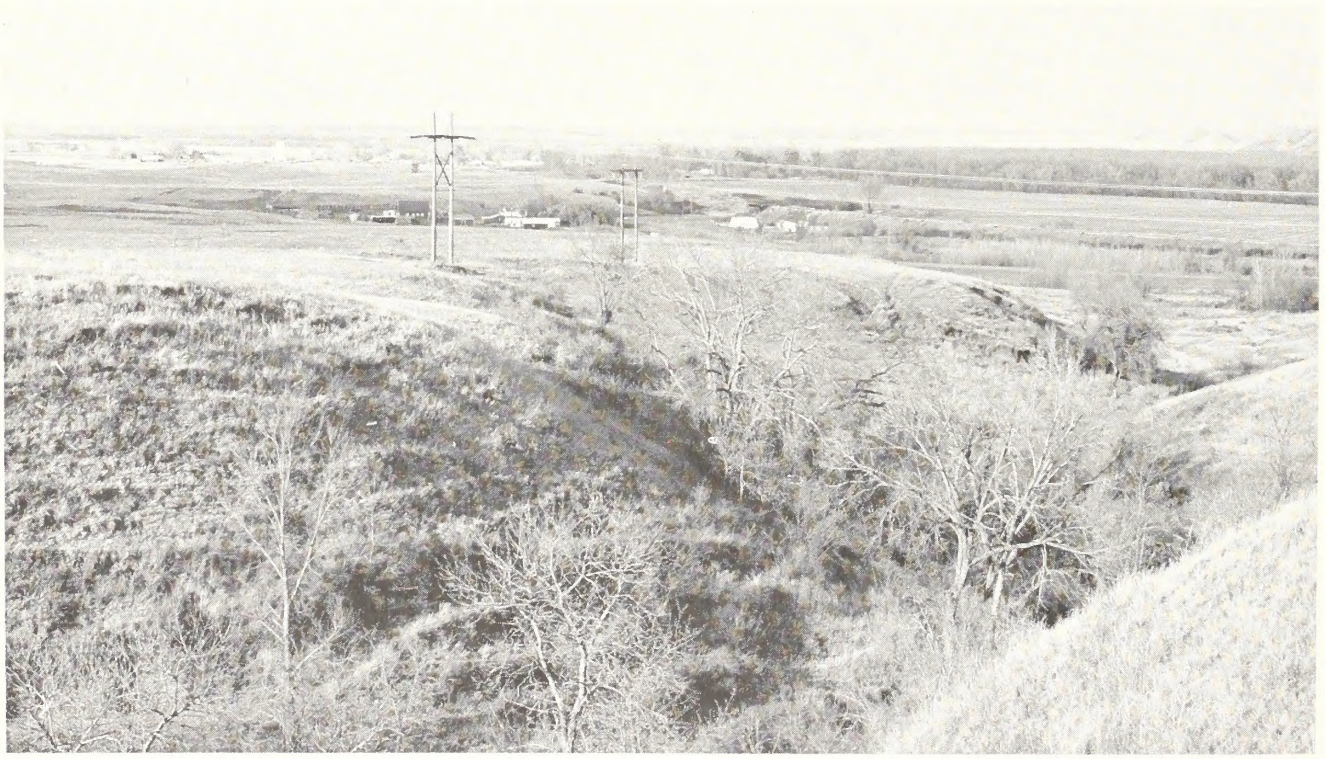
A. Class I (Preservation). This class provides primarily for natural ecological changes only. It is applied to primitive areas, some natural areas, and other similar places where management activities are to be restricted.

B. Class II (Retention of the Landscape Character). Changes in any of the basic elements (form, line, color, or texture) caused by a manage-

Figure 2-10

Plains Landscape

SOURCE: Bureau of Land Management 1977

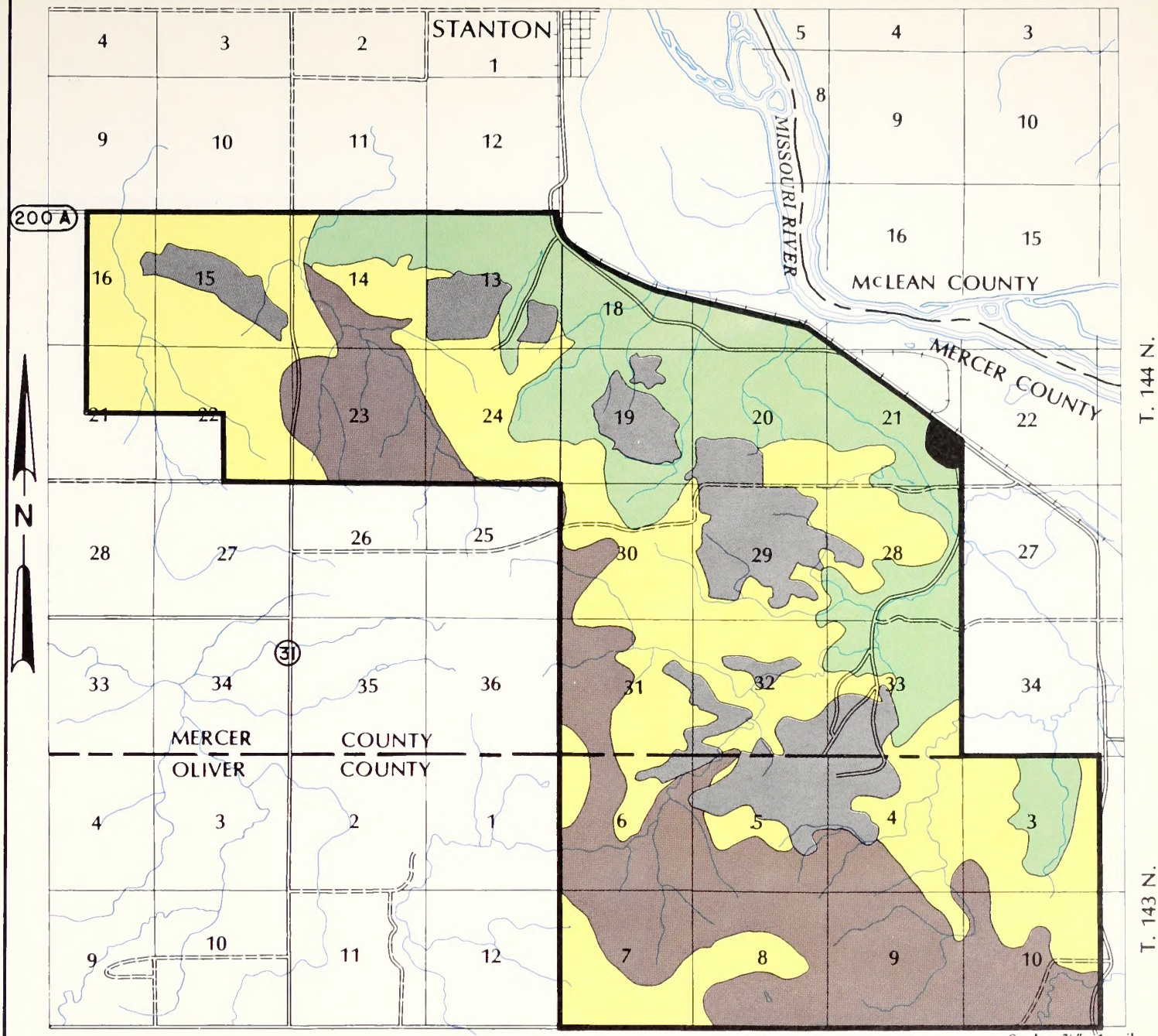


Missouri River in Background and Breaks Type of Topography in Foreground

Figure 2-11

SOURCE: Bureau of Land Management 1977

MAP 2-9



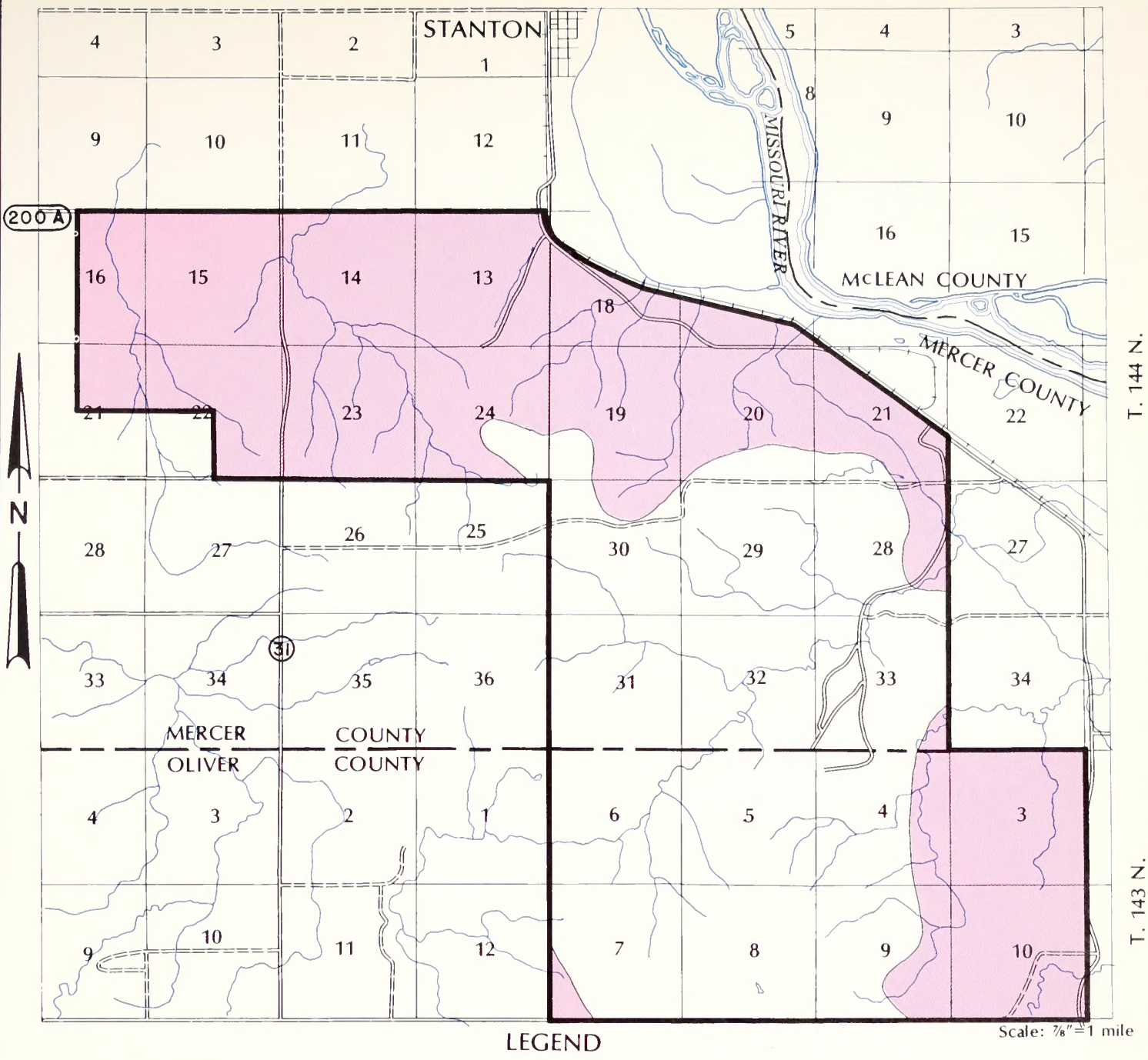
LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Plains
- Missouri River
- Breaks Topography
- Mined Out Areas
- Operational Area: Office, Maintenance Buildings, Loading Facilities, etc.

SOURCE: Araki, 1977.

SCENERY UNITS

MAP 2-10

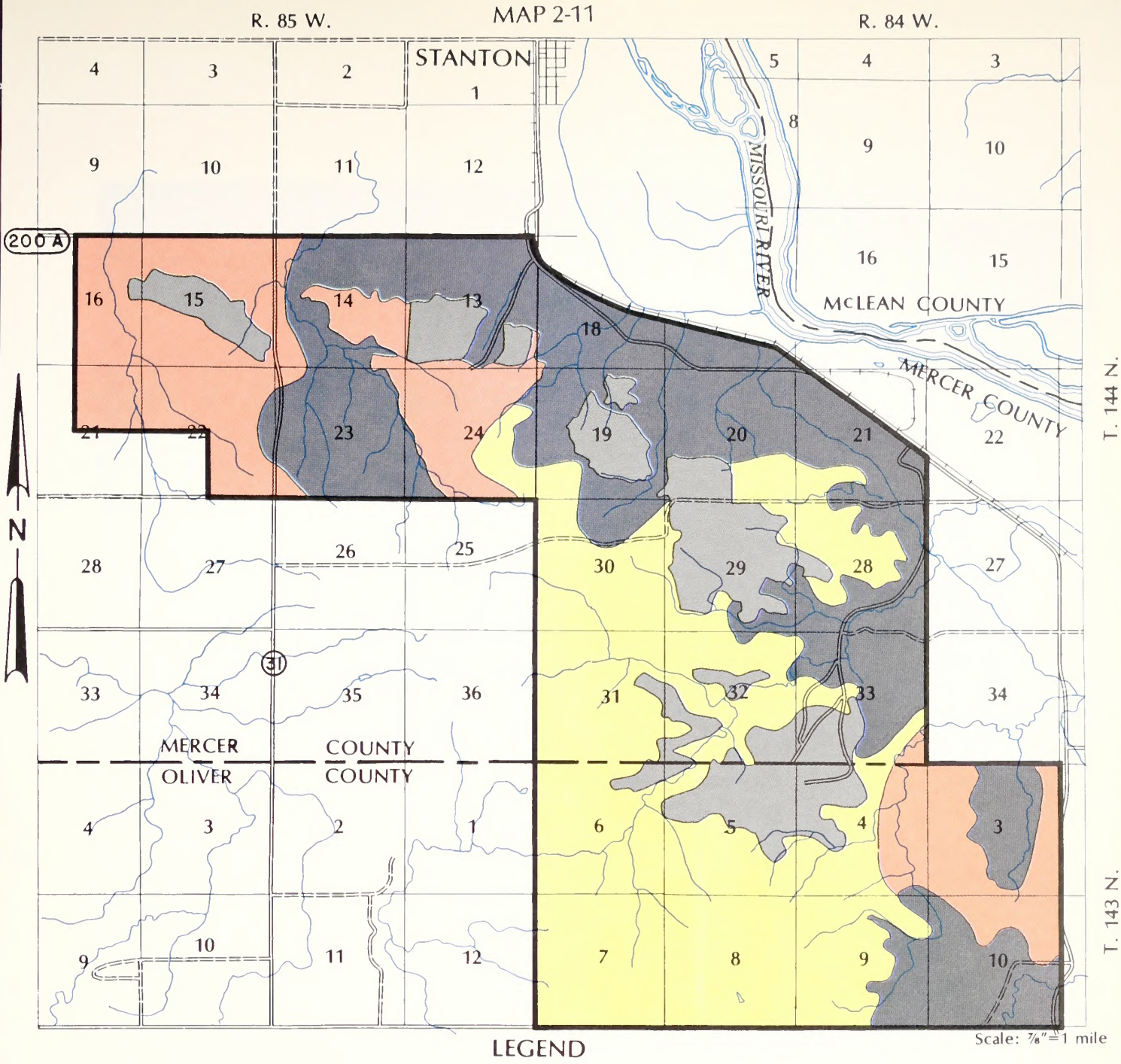


LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- High Sensitivity: Foreground - Middleground
- Low Senstivity: Seldom Seen

SOURCE: Araki, 1977

VISUAL SENSITIVITY AND VISUAL ZONES



SOURCE: Araki, 1977

VISUAL RESOURCE MANAGEMENT CLASSES

Figure 2-12

Impoundment in the Old Mine Spoils Area

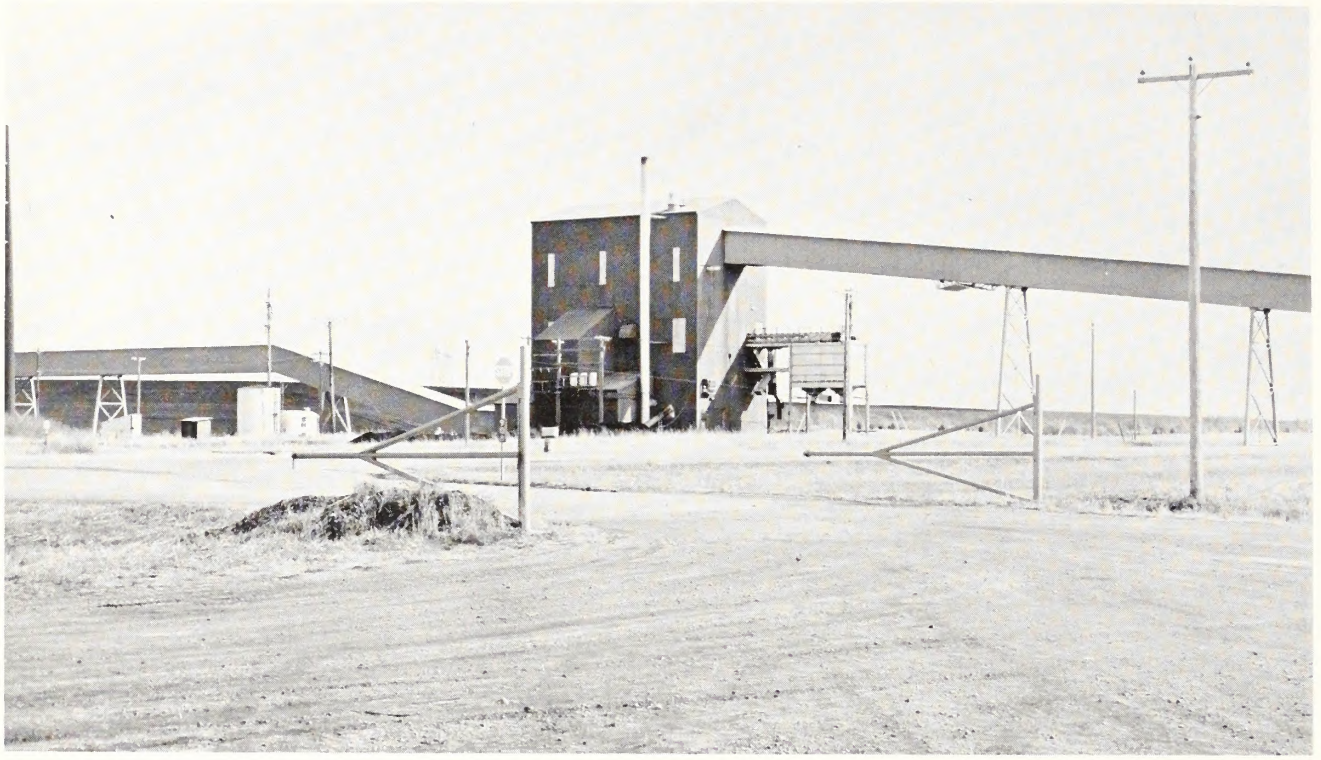
SOURCE: Bureau of Land Management 1977

Office Building

Figure 2-13

SOURCE: Bureau of Land Management 1977

Figure 2-14



Loading Facility

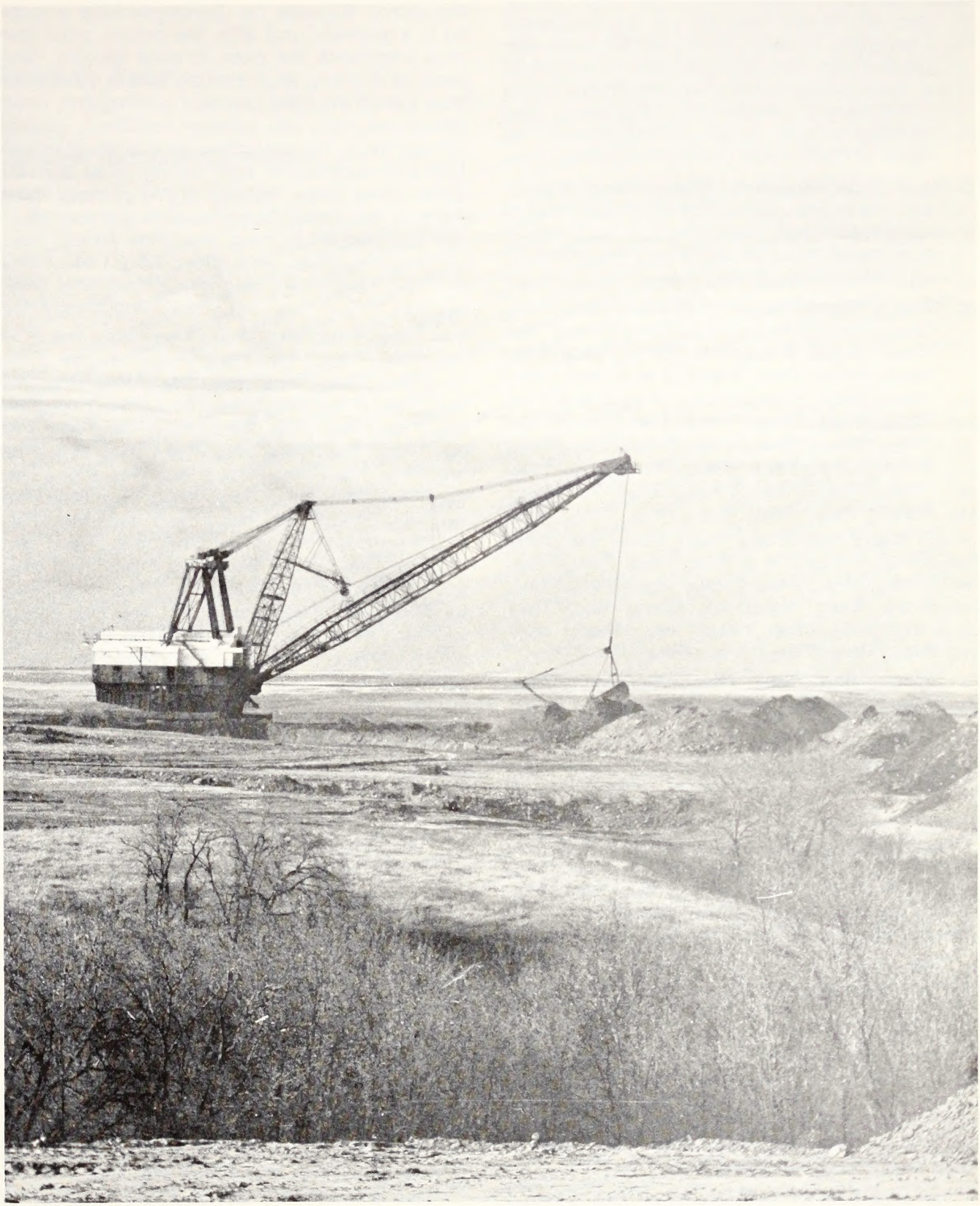
SOURCE: Bureau of Land Management 1977

Power Station and Utility Lines

Figure 2-15

SOURCE: Bureau of Land Management 1977

Figure 2-16



Mining Activity

SOURCE: Bureau of Land Management 1977

ment activity should not be evident in the characteristic landscape.

C. Class III (Partial Retention of the Landscape Character). Changes in any of the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing character.

D. Class IV (Modification of the Landscape Character). Changes may subordinate the original composition and character, but must reflect what could be a natural occurrence within the characteristic landscape.

E. Class V (Rehabilitation or Enhancement of the Landscape Character). Change is needed. This class applies to areas where the natural appearance has been disturbed to a point where rehabilitation is needed to bring it back into harmony with the surrounding countryside. This class would apply to areas identified in the scenery evaluation where the quality of the class has been reduced by unacceptable intrusions.

No Class I areas are found in the Glenharold project area. Class II and III areas lie primarily within the visual corridors major highways. Class IV areas are mostly outside of highway visual corridors. Class V areas include the existing unreclaimed areas and the mining operational area.

The visual resource would retain the existing landscape character within the proposed project.

Sound

No ambient sound level studies have been conducted in the Glenharold Mine area; however, studies in Mercer and Dunn Counties for other energy related developments can be applied in general terms to the Glenharold Mine area.

The existing mining operations produce noise above the background noise levels usually associated with a rural environment. Mining involves noise producting activities such as exploration; topsoil, subsoil, and overburden removal; soil stockpiling; coal blasting and removal; coal hauling; and reclamation. Equipment that produces noise at the Glenharold Mine includes draglines, scrapers, trucks and automobiles, pumps, power shovels, tractors, drills, and numerous other engines.

Distance from the noise source is a major determinant in the perception of various noises. A sound or noise radiating into an area free from buildings and other obstructions will decrease approximately 6 decibels for each doubling of the distance from the source. Because the Glenharold Mine is located in a generally rural area, few people, other than mine employees, are close to noise sources. Residents of Stanton, approximately one to three miles from the mining area, can hear blasting and, under appropriate wind and weather conditions, machinery operation. The only other large group of individuals who consistently hear mining noise are residents along State Highway 200A, primarily those living in the mobile home court in Section 18, T. 144 N., R. 84 W.

Odor

Odors experienced at the site are those associated with a non-polluted, rural, farm-type environment. Included would be odors of livestock, dust, agricultural chemicals, petroleum distillates, and operation of machinery. Mining activities add a non-quantifiable amount of odors of dust, petroleum distillates, machinery operation, and certain volatiles of the coal. Odors from both mining and rural environments are usually closely associated with their source. However, odors such as dust from unpaved roads and combustion odors near operating agricultural and mining equipment are often dispersed by strong winds and are seldom perceived any significant distance from the source.

Short-Term Application Area

The short-term application area includes many of the same scenery units as previously discussed (Map 2-9). The scenery units exclusively in the short-term area are the breaks topography and the plains.

Some areas, such as those within the visual corridors of Highway 31 and 48, are high sensitivity and are within the foreground-middleground zone (Map 2-10). The visual resource management classes are shown on Map 2-11).

Sounds and odors, principally of rural origin, are similar to those previously discussed.

RECREATION

Project Area

Outdoor Recreation Areas

Federal recreation proposals pertain to two features that lie within two miles of the project area. These are (1) the Knife River Indian Villages National Historic Site, and (2) the Lewis and Clark National Historic Trail.

At the proposed Knife River Indian Villages National Historic Site, immediately north of Stanton, the National Park Service plans to protect and interpret a cluster of four earthlodge Indian villages on 1,292 acres of land near the confluence of the Knife and Missouri Rivers (National Park Service 1975). According to Lancaster (1976, personal communication), visitation at the historic site is expected to reach 25,000 to 30,000 persons in 1981, its first year of operation (Alderson 1977, personal communication). The existing mining operation can be seen by visitors as they approach Stanton along State Highway 200A. In addition, the sounds of mining can occasionally be heard at the historic site.

The Lewis and Clark National Historic Trail (designated in late 1978) would follow the Missouri River from St. Louis to the headwaters, including the 75 mile free-flowing segment which passes less than one mile from the project area (Bureau of Outdoor Recreation 1976). This trail would be a water trail, with little recreation development except for a few campgrounds at one-day travel intervals on the federal land of Lake Sakakawea and Lake Oahe. The trail would provide a historically-based recreation experience and commemorate the 3,700 mile journey of Lewis and Clark and the Corps of Discovery. The National Park Service must complete a comprehensive plan for the trail by the end of 1982. Planning is expected to begin in 1980. The shoreline of the Missouri River near the project area is no longer natural due to two electric generating plants and the nearby Glenharold Mine.

Fort Clark State Historic Site, four miles each of the project area, is administered by the State Historical Society. This site is a former frontier trading post (1822-1862) and Mandan earthlodge village and is interpreted for visitors. Visitation in 1976 averaged approximately 275 individuals per week in May through September. Visitation drops substantially during the fall and winter (Holland 1976, personal communication).

The Lewis and Clark Highway Trail administered by the State Highway Department includes State Highway 200A and borders the project area for over six miles. Much of the project area along State Highway 200A has already been mined and partially reclaimed. Designation of this highway as a tourist route by North Dakota is part of a multi-state effort to commemorate the Lewis and Clark journey of exploration.

There are no county recreation lands or facilities in or adjacent to the project area. The nearest municipal recreation lands are found one mile north of the project area in Stanton. There are no developed private recreation sites in or adjacent to the project area. No fragile or unique biological, geological, or paleontological areas of scientific or educational value have been identified in the project area.

The number of tourists who visit the area is not known. According to the State Travel Division, the tourism potential of the area has barely been developed. Population growth, improved access, scenic roads, the statewide increase in tourism, and the development of the Knife River Indian Villages National Historic Site will likely make historical, recreational, and archaeological areas near the project area extremely valuable as tourist attractions in the future.

Outdoor Recreation Activities

The primary outdoor recreation activity in and adjacent to the project area is hunting for upland game, big game, and predators.

The mine property provides good hunting opportunities for Glenharold Mine employees and guests. Due to posting of surrounding land, company officials allow employees to hunt, primarily upland game, on project lands. Hunting in the mining area by non-employees is discouraged but not prohibited (Huschka 1976, personal communication).

Species hunted in and adjacent to the project area include sharp-tailed grouse, pheasants, Hungarian partridge, and turkeys. Squirrels and cottontails are also considered upland game but are taken incidentally to other species. Upland game hunting in Mercer and Oliver Counties totaled 12,406 man days in 1973, according to Trego (1975). More than half of these man days (6,967) were spend hunting sharptails. The project area sustains slightly less sharptail hunting pressure than the rest of the county.

Pheasants, hunted in river breaks and creek draws of the project area, receive hunting pressure

beginning in mid-October. Pheasant hunters in the project area numbered an estimated 15 to 20 per day during the first 1 1/2 weeks of the 1976 season (Huschka 1976, personal communication). According to Burkett (1976, personal communication), Hungarian partridge are present in adequate numbers, but hunting pressure is low and they are taken incidentally to sharptails and pheasants.

Big game is a significant factor attracting hunters to the project area. Burkett states that most big game (white-tailed deer) hunting occurs in the river bottoms, river breaks, and creek beds. Mule deer are also present, but not in large enough numbers to be hunted annually. They prefer rough mine spoils and river breaks so they are often seen inside the project area (Burkett 1976, personal communication).

According to Burkett, at least one party of one to four people per day hunts predators (mostly fox and coyote) in the project area throughout the winter. Predators are found in the uplands as well as in spoils of the project area. Future trends in predator hunting will largely depend on pelt prices. If pelt prices remain high, hunting pressure will likely increase. It has been predicted that as other game species become less available, hunters will seek predators as a substitute for upland and big game (Trego 1976).

Visiting historic sites is popular among North Dakotans. In a 1973 survey of 10,000 households, the State Parks and Recreation Department (1976) determined that nearly half (44.6%) of the state's residents visited historic sites that year. By 1990, participation is expected to increase 25% (State Parks and Recreation Department 1976). As interpretation at Knife River Indian Villages National Historic Site is completed and Fort Clark State Historic Site is expanded, similar participation trends could be expected near the project area.

Short-Term Application Area

No federal, state, or local recreation areas are on or immediately adjacent to the short-term application area. No federal or state recreation related proposals or special designations (such as wilderness or state nature preserve) occur on or immediately adjacent to the area. Because the surface is in private ownership, no such proposals are expected in the future.

The primary outdoor recreation activity is hunting for upland game, big game, and predators. The discussion of hunting provided for the project area is generally applicable to the short-term application area as well. No hunting use figures are available for the short-term area. Most hunting activity focuses on sharp-tailed grouse, pheasants, and Hungarian partridge.

ECONOMIC AND SOCIAL CONDITIONS

Project Area

Employment

Current employment conditions in the Mercer-Oliver County area and the state are shown in Table 2-23. Both counties had an annual average unemployment rate above that for North Dakota in 1976.

The 156 Glenharold Mine employees comprised 4.5% of Mercer County's 1976 annual average employment. Assuming that there are 1.7 indirect workers for each direct worker (Dalsted and Toman 1976, personal communication), it is estimated that approximately 265 indirect workers are employed nearby as a result of the Glenharold facility. Indirect workers are typically engaged in sales and service employment in response to the demand for goods and services generated by the direct workers. Consequently, total direct (156) and indirect (265) employment resulting from the Glenharold facility is estimated at 421. This represents 9.0% of the two county area's 1976 annual average employment (North Dakota Employment Security Bureau 1977).

Population

Population in Mercer and Oliver Counties declined significantly from 1960 to 1970 (Table 2-24). Even though the total population in both counties fell during this period, several of the larger communities experienced population gains. The rural nature of the area is reflected in the fact that no communities in the two counties were classified by the U.S. Census Bureau (1972) as "urban" in 1970 (i.e.; 2,000 or more inhabitants).

Most of the 156 employees at the Glenharold Mine reside in the Hazen-Stanton-Washburn area. Assuming that 87% of the direct employees are married and assuming that the average family size is 3.67 people (Leholm et al. 1975), approximately

TABLE 2-23

NORTH DAKOTA LABOR FORCE - 1975 ANNUAL AVERAGE

	Labor Force	Employment	Unemployment Number	Unemployment Rate
Mercer	3,711	3,476	235	6.3%
Oliver	1,299	1,213	86	6.6%
North Dakota	292,750	276,380	16,370	5.6%

SOURCE: North Dakota Employment Security Bureau 1977

TABLE 2-24

COUNTY - INCORPORATED COMMUNITY POPULATION CHANGE

County/Community	Population 1960	Population 1970	% Change 60-79	Estimated Population 1975	% Change 70-75
Mercer	6,805	6,175	- 9.3	6,244	1.1
Beulah	1,318	1,344	2.0	1,494	11.2
Golden Valley	286	235	-17.8	239	--
Hazen	1,222	1,240	1.5	1,493	20.4
Stanton	409	517	26.4	749	44.9
Zap	339	271	-10.1	281	3.7
Oliver	2,610	2,322	-11.0	2,618	12.7
Center	476	619	30.0	970	56.7

SOURCE: U.S. Department of Commerce 1972.

NOTE: 1975 population estimate from North Dakota Regional Environmental Assessment Program 1977

519 people in Mercer and Oliver Counties are either Glenharold Mine employees or their dependents. This figure represents 5.9% of the estimated 1975 total two county population of 8,862 (North Dakota Regional Environmental Assessment Program, Economic-Demographic Model 1977).

The 265 indirect workers are assumed to have an average family size of 3.25 people (average North Dakota family size - 1970 Census). Based on this estimate of average family size, 861 people in the project area are either indirect workers or their dependents (assuming 100% of the indirect workers are married). Combining this figure with the total direct employee/dependents figure, it is estimated that 1,380 people in the project area are directly or indirectly associated with the Glenharold facility. This represents 15.6% of the estimated 1975 two county population.

Income

Per capita personal income has increased steadily from 1972 to 1974 in Mercer and Oliver Counties. The payroll from the Glenharold Mine has undoubtedly contributed to this increase. Total sales for incorporated places in Mercer County and Oliver County have risen 36% and 101%, respectively, during the period 1973-1975 due, in part, to the economic influence of the Glenharold Mine.

The total annual payroll of the Glenharold facility in calendar year 1976 was $2,948,000 (Consolidation Coal Company (1978) estimate). This direct payroll figure represents 14.2% of total 1974 private non-farm personal income ($20.7 million) in Mercer County. While these dollar figures can be expressed as a percentage of Mercer County earnings for comparison purposes, it is unlikely that all of the purchases by Glenharold Mine employees were in that county. Some purchases by the direct employees were made in the Bismarck-Mandan area. For that reason, it is likely that 1976 expenditures by Glenharold Mine employees in Mercer County were less than the full payroll amount.

Non-payroll expenditures by the Consolidation Coal Company (e.g., fuel, tires, vehicles, and other items) in Mercer County during calendar year 1976 are estimated by the company to be $374,974. This figure represents 1% of total 1975 non-service retail sales in incorporated communities in Mercer and Oliver Counties.

Public Finance

Coal mined in North Dakota is subject to a state severance tax. As of July 1, 1977, the tax rate base is $0.65 per ton of coal mined, escalated on a quarter-annual basis by one cent for every point which the national Wholesale Price Index would rise during the quarter previous to mining (HB 1262). Thus, the effective rate on coal mined during the July-September 1977 quarter would be $0.65 per ton; during October-December 1977 quarter, it would be $0.65 plus one cent for each point difference between the reported June (base month) and September 1977 indexes (estimated to be $0.68).

The original state coal severance tax was enacted July 1, 1975, at a $0.50 base rate to be escalated one cent for each three point rise in the index (North Dakota Century Code 57-61-01). As a result, the average annual tax during 1976 of $0.5275 per ton generated about $3 million from the nearly 5.7 million tons of coal mined in Mercer County in 1976, and about $1.1 million from Oliver County's 2.1 million tons of coal production (North Dakota Department of State Tax 1977).

The 3,706,718 tons of coal produced at the Glenharold Mine during 1976 represented about 65% of total Mercer County production that year (5,675,828 tons), or about 33% of total state coal production (11,177,625 tons). Consolidation Coal Company contributed nearly $2 million in total severance tax revenues from this mine.

Revenues from severance tax collections made prior to July 1, 1977, were distributed 30% to the State General Fund, 30% to the Coal Development Trust Fund, 35% to the Coal Impact Office for grants to coal development impacted local governments, and 5% to the General Fund of the county where the coal was produced (North Dakota Century Code 57-62-02).

The 3.7 million tons expected to be mined at the Glenharold Mine in 1977 would generate an estimated $2.3 million in severance tax revenues (assumes an average tax rate for the year of $0.61). Since only the first quarter tax was collected prior to July 1, 1977, it was distributed under the original distribution formula. Tax collections for the rest of 1977 would be distributed according to the formula contained in the new severance tax law (HB 1262) which allocates 30% of the revenue to the State General Fund, 15% to the Coal Development Trust Fund, 35% for grants by the Coal Impact Office, and the remaining 20% to the county of production for distribution among the county (40%), cities (30%), and school districts (30%). County governments thus actually receive 8% of total severance tax revenues generated

within their county, and the cities and school districts each divide their 6% shares based upon relative populations and average daily memberships, respectively. The actual collection and distribution of first quarter 1977 severance tax on coal produced at the Glenharold Mine and an estimate of the collection and distribution of the rest of the year's production is shown in Table 2-25.

The Coal Impact Office has made grants to various political subdivisions within Mercer and Oliver counties from its share of the state severance tax collections. Between the first grants in September 1975 and mid-July 1977, local governments in Mercer County had been awarded nearly $2 million in Impact Office grants, and over $500,000 was granted for Oliver County political subdivisions' use. These funds have been of substantial aid to local governments in meeting the public service expansion costs resulting from increased population associated with electric power plant and coal mine construction and operation activity in the area.

The mining of 766,446 tons of leased federal coal reserves by Consolidation Coal Company at the Glenharold Mine during 1972 and 1973 generated $144,971 in royalty payments (15 cents per ton). Of this amount, the state of North Dakota received 37.5%, or $43,114. As of August 4, 1976, the royalty payment on federally owned surface mined coal is to be no less than 12.5% of the selling price of the coal and the state is to receive 50% of this amount (Section 7, Federal Coal Leasing Amendments Act of 1975). Therefore, if federally owned surface mined coal at Glenharold would have a selling price of $4.40 per ton, a 12.5% royalty would amount to $0.55 per ton of which the state would get $0.275 per ton. No federal coal has been mined at Glenharold between 1973 and 1977.

Local property tax revenues derived annually from the Glenharold Mine are minimal. Since only real property is taxed in North Dakota, only buildings and land are assessed for tax purposes. The 1975 assessed valuation of the facilities owned by Consolidation Coal Company at the Glenharold Mine were $5,082 for 143.9 acres of land and $10,000 for buildings (assessed valuation in Mercer County as a whole during 1974-1975 averaged only 8.9% of market value according to the North Dakota State Tax Department's 1976 Sales Ratio Study). Since taxable valuation is 50% of assessed valuation, Consolidation Coal Company paid property taxes on only $7,541 of taxable valuation, which amounted to $1,234 (total 1975 Mercer County and school district levy of 163.67 mills).

Agriculture

The amount of surface land subject to agricultural use in the Glenharold Mine project area totals 11,186 acres, or 73% of the total project area acres. Of this productive acreage, 3,022 acres (20%) are cropland, and 8,164 acres (53%) are lands with capability for domestic livestock grazing. A portion of 2,039 acres of woodland (13% of the project area) also could receive some livestock use.

The acreage within Glenharold's mining plan totals 3,547 acres. Of this, 663 acres (19%) is cropland, and 2,265 acres (63%) are lands with livestock grazing capability (grassland and shrubland).

According to the 1974 Census of Agriculture (U.S. Department of Commerce 1976), Mercer County had 304,137 acres in cropland during 1974 with a total crop sales value of $7,418,000 (an average of $24.39 per acre). The 295,940 acres of grazing land generated an additional $7,199,000 in livestock sales value (an average of $24.32 per acre). Thus, it can be assumed that the 764 acres of cropland within the Glenharold Mining plan had an approximate annual productive capability of $18,600 and the 3,165 acres of grazing land about $77,000 in 1974. This amounts to about 0.5% of the total 1974 Mercer County saleable agricultural output.

Because of the present potential for agriculturally productive use of this land, it can be expected that crops and livestock will continue to be grown in the future if not affected by mining.

Health

Acute shortages of medical facilities and manpower exist in Mercer and Oliver Counties. The medical manpower shortage is most critical for physicians. The Mercer-Oliver County area has a total of three physicians, all in Mercer County. The national ratio of physicians per 1,000 population is 1.58. The physician/population ratio for the Mercer-Oliver County area is .36 per 1,000 population. The single 39-bed hospital in the two county area is in Mercer County.

The direct and indirect employees and their dependents associated with the Glenharold Mine are estimated to generate approximately 15 to 20% of the local demand for medical services. This is based on the estimate that the number of Glenharold's direct and indirect employees and dependents

TABLE 2-25

ESTIMATED NORTH DAKOTA STATE SEVERANCE TAX COLLECTIONS
AND REVENUE DISTRIBUTION IN 1977 FROM THE GLENHAROLD MINE

I. COLLECTION

Quarter	Tons Mined	Tax Rate	Tax Collected
January-March	980,693	$0.55	$ 539,382
April-June	939,769	0.56	526,271
July-September	939,769	0.65	610,850
October-December	939,769	0.68	639,043
TOTALS	3,800,000	--	$2,315,546

II. REVENUE DISTRIBUTION

A. 1st Quarter	% of Total	Amount
State General Fund	30%	$ 161,815
Coal Development Trust Fund	30%	161,815
Coal Impact Office	35%	188,783
Mercer County	5%	26,969
		$ 539,382

B. 2nd-4th Quarters		
State General Fund	30%	$ 532,849
Coal Development Trust Fund	15%	266,425
Coal Impact Office	35%	621,657
Mercer County	8%	142,093
Incorporated Cities	6%	106,570
School Districts	6%	106,570
		$1,776,164

C. Distribution Among Cities of 2nd-4th Quarter Revenues

City	Census Population	% of Total	Amount
Beulah	1,593	36.5%	$ 38,898
Hazen	1,558	35.7%	38,046
Stanton	583	13.4%	14,280
Zap	271	6.2%	6,607
Golden Valley	235	5.4%	5,755
Pick City	119	2.8%	2,984
TOTALS	4,359	100.0%	$ 106,570

D. Distribution Among School Districts of 2nd-4th Quarter Revenues

School District	% of Total	Amount
Beulah	31.0%	$ 33,037
Hazen	30.7%	32,717
Stanton	15.4%	16,412
Zap	6.0%	6,394
Golden Valley	7.7%	8,206
Others	9.2%	9,804
TOTALS	100.0%	$ 106,570

SOURCE: Data from North Dakota State Tax Department, State Treasurer's Office, and the Mercer County Superintendent of Schools and Treasurer 1977.

make up 16.6% of the total Mercer-Oliver County area population.

Housing

Standard housing information for Mercer and Oliver Counties is based on 1970 conditions, the most recent data available. In 1970, housing units in the Mercer-Oliver County area totaled 3,020 (Bureau of the Census 1972). Assuming 7.5 housing units per 10 employees, 316 housing units would be occupied by direct and indirect employees of the Glenharold Mine. This represents 10.5% of the housing units in the Mercer-Oliver County area.

In 1970, there were few vacant housing units in either county Bureau of the Census 1972); while in 1976, a housing shortage existed in the Mercer-Oliver County area. Direct communication with city officials in Mercer and Oliver Counties indicated few housing units for sale or rent (November 1976).

Housing units within the Glenharold Mine project area total 41, comprised of 9 one-unit structures and 32 mobile homes. Eight of the one-unit dwellings are occupied, and one unit has been abandoned. All mobile homes are in a 39-pad mobile home court built in 1966.

Population in the housing units in the mine project area totals 97, including 79 occupying the mobile homes and 18 occupying one-unit dwellings. A majority of the mine project area population is employed by energy projects in the Mercer-Oliver County area.

Education

A total of 331 students in the Mercer-Oliver County area are estimated to be dependents of direct and indirect workers associated with the Glenharold Mine. This is assuming the same population/student ratio as that for the Mercer-Oliver County area. This number represents 16.6% of the total Mercer-Oliver County student enrollment (see Appendix 2, Figure 2).

Short-Term Application Area

The social and economic conditions in Mercer and Oliver County were discussed in detail previously in this chapter. Those conditions can be considered applicable to the short-term application area.

LAND USE

Project Area

The project area includes 21 full sections of land and portions of 7 additional sections. Approximately 67% of the project area lies in Mercer County with the remaining 33% in Oliver County.

The project area land use pattern is one of dryland farming, livestock production, and surface mining. Table 2-26 and Map 2-12 illustrate the mix of uses within the project area and the proposed mining plan. Uses are classified according to the Geological Survey's land use and cover classification system, commonly known as the "Anderson System" (Anderson et al. 1976).

Urban or built-up uses constitute about 1%, or 131 acres, of the project area. The Hillside Trailer Court occupies 13 acres in the southwest quarter of Section 18, T. 144 N., R. 84 W., and has 39 hook-ups, 32 of which are presently used. The remaining 119 acres lie in an industrial area in the southwest corner of Section 21, T. 144 N., R. 84 W., south of State Highway 200A. This area contains an electrical sub-station tied to Basin Electric Power Cooperative's Leland Olds Plant; a railroad siding; a sewage lagoon; mine shops, offices, parking lot, and storage yard; and the mine tipple. No urban/built-up areas lie within the proposed mining plan.

In addition to the trailer court, there are 13 occupied homesteads in the project area.

Cropland, including hayland, comprises nearly 19% of the project area. Approximately 682 acres have been classified as specific prime farmland. The project area contains 582 acres of Fort Clark Irrigation District land, all located outside the proposed mining plan.

Rangeland, both herbaceous and shrub or brush, comprises 53% of the project area.

Forested or wooded lands, usually found in the drainage ways and draws, occupy 13% of the project area.

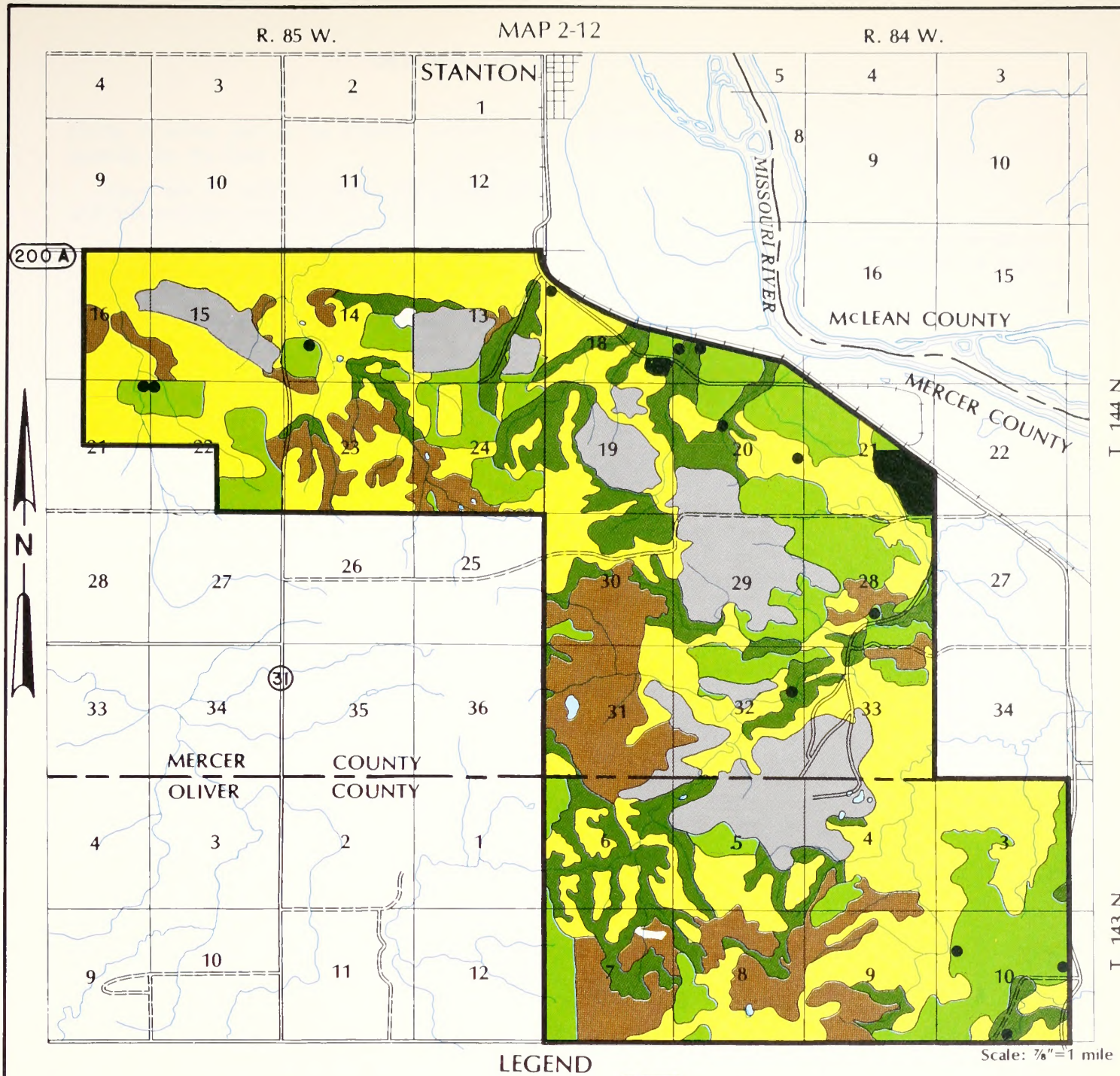
Surface water in the project area is limited to potholes, water-filled remnants of past mining activity, a number of intermittent streams, and 17 stock

TABLE 2-26

LAND USE

Classification	Glenharold Project Area Acres	Glenharold Project Area Percent	Proposed Mining Area Acres	Proposed Mining Area Percent	Federal Subsurface in Proposed Mining Area Acres	Federal Subsurface in Proposed Mining Area Percent
Urban/Built-up	131	1%	5	1%	--	--
Cropland	3,022	20%	663	19%	266	27%
Rangeland						
Grass	6,036	40%	1,379	39%	382	39%
Shrub	1,997	13%	881.	25%	201	21%
Forest Land/Wooded	2,039	13%	612	17%	132	13%
Barren Land	1,978	13%	--	--	--	--
Wetland	--	--	--	--	--	--
Water	21	/ 1%	7	/ 1%	2	/ 1%
TOTAL	15,223	100%	3,547	100%	983	100%

SOURCE: BLM and Larson 1977



SOURCE: Bureau of Land Management 1977

LAND USE

ponds. A canal, part of the irrigation system, also extends into the area.

There are no wetlands within the project area and little shoreline vegetation.

Spoils, topsoil banks, and regraded areas result from current mining operations, which disturb an average of 211 acres annually. Spoil piles and other scars remain from the period when reclamation was not mandatory.

Transportation

Numerous arterial and collector state highways serve the project area. Map 2-13 illustrates the various routes and functional classifications.

Two minor arterials, Highways 200A and 31, traverse the project area. Highway 200A borders the northern boundary of the project area, running west to Hazen and east to Washburn. Highway 200A provides access to the mine area and the nearby generating plants bridged by facilities conveying coal from the mine tipple to the Basin Electric Power Cooperative's generating plant. Highway 31 crosses through the west extension of the project area and intersects with Highway 200A. Another arterial, Highway 200, carries traffic across the Garrison Dam southward to its intersection with Highway 200A, one and onehalf miles west of the project area. Highway 48, between Center and the Highway 200A intersection, and the Highway 31 spur to Stanton are classed as major collectors. The spur provides access to Stanton from Highway 200A. All arterials and collectors are mixed bituminous, hard-surfaced roads. Traffic volumes are heaviest on Highway 200A, averaging 1,176 cars daily (North Dakota State Highway Department 1976). Traffic on Highway 31 averages 460 cars daily near the project area. The mine is served by haul roads, maintained by Consolidation Coal Company, that extend from the tipple and shop area to the mines. The haul roads also provide access to two homesteads within the project area in Sections 28 and 32. Numerous primitive roads and trails are found throughout the area.

Due to the proximity of the Glenharold Mine to the United Power Association and Basin Electric Power Cooperative generating plants, many transmission lines cross or border the project area. None of the lines cross land included in the proposed mining plan.

Ownership

Surface

All surface within the project area is privately owned. Consolidation Coal Company owns approximately 4,500 of the 15,223 project area acres. The balance is distributed among 32 other private owners.

Subsurface

Subsurface acreage ownership is divided, with substantial public and private holdings. Federal ownership comprises 4,550 acres (30% of the total mineral acreage), and is shown on Map 1-4. The federal government leases 561 mineral acres within the project area to Consolidation Coal Company. Lease No. 070203 containing 401 acres was leased November 1, 1965, and lease No. M11260 containing 160 acres was leased May 1, 1979. These existing leases are also shown on overlay No. 1. State subsurface ownership consits of 160 acres in the northwest corner of Section 28, T. 144 N., R. 84 W.; and 320 acres in Section 16, T. 144 N., R. 85 W. The 160 acre tract was formerly owned by the Bank of North Dakota with a 50% reservation. The Bank of North Dakota leased this tract to Consolidation Coal Company in 1972, and mining was completed in 1976. Bank of North Dakota mineral holdings were consolidated with State Land Department holdings in July 1977. The 320 acre tract was leased in 1978 and is presently being mined.

Planning and Zoning

Because the project area straddles the boundary between Mercer and Oliver Counties, it falls under two separate planning and zoning jurisdictions. The Mercer County portion of the project area is zoned entirely agricultural, with the exception of the Hillside Trailer Court. The trailer court, located in the southeast quarter of Section 18, is classified as a Mobile Home Park District. The purpose of the Agricultural District is to "encourage the use of this land for agricultural activities and discourage any use which would be detrimental to carring out the primary function of the area - agriculture" (Mercer County Planning and Zoning Commission 1975). The Commission further mandates that land with potentially irrigable soils or prime productive soils be reserved only for agricultural activity. Mineral exploration operations and coal excavation and mining are conditional uses in an Agri-

TABLE 2-27

LAND AUTHORIZED FOR MINING UNDER CONDITIONAL USE PERMIT
GRANTED BY MERCER COUNTY

Township	Section	Description	Acres
T. 144 N., R. 84 W.	18	SE¼	160
T. 144 N., R. 84 W.	19	Entire	640
T. 144 N., R. 84 W.	20	S½	320
T. 144 N., R. 84 W.	29	Entire	640
T. 144 N., R. 85 W.	13	S½, S½ of N½	480
			2,240

SOURCE: Mercer County Land Use Administrator 1977.

cultural District, allowable following issuance of conditional use permits. The Glenharold Mine is now operating under a conditional use permit approved by the Mercer County Board of Commissioners in July 1976. The permit, which has an indefinite expiration date, authorizes mining activity on the lands listed in Table 2-27. Map 2-14 shows the location of these lands. The permit is subject to standard conditions requiring adherence to North Dakota reclamation law, state and federal archaeological laws, and setback regulations. These regulations forbid mining operations within 125 feet of a residence unless otherwise agreed to by the owner; and within 300 feet of an adjacent property line, plus one foot horizontal for each foot of vertical excavation, unless otherwise agreed to by the property owner. There were no special conditions attached to the permit beyond the specified conditions.

Outside the project area boundary, most of the land in proximity is also classified as agricultural (Map 2-14). However, the adjacent United Power Association and Basin Electric generating plant sites (those portions of Sections 16, 21, 22, and 23, T. 144 N., R. 84 W., south of the Missouri River and north of Highway 200A) are zoned Industrial, as is a small tract of land near the Stanton railroad underpass. Sections 25, 26, and 36, T. 144 N., R. 84 W., south of the Missouri River, encompass the Fort Clark Historic Site and are zoned Recreational.

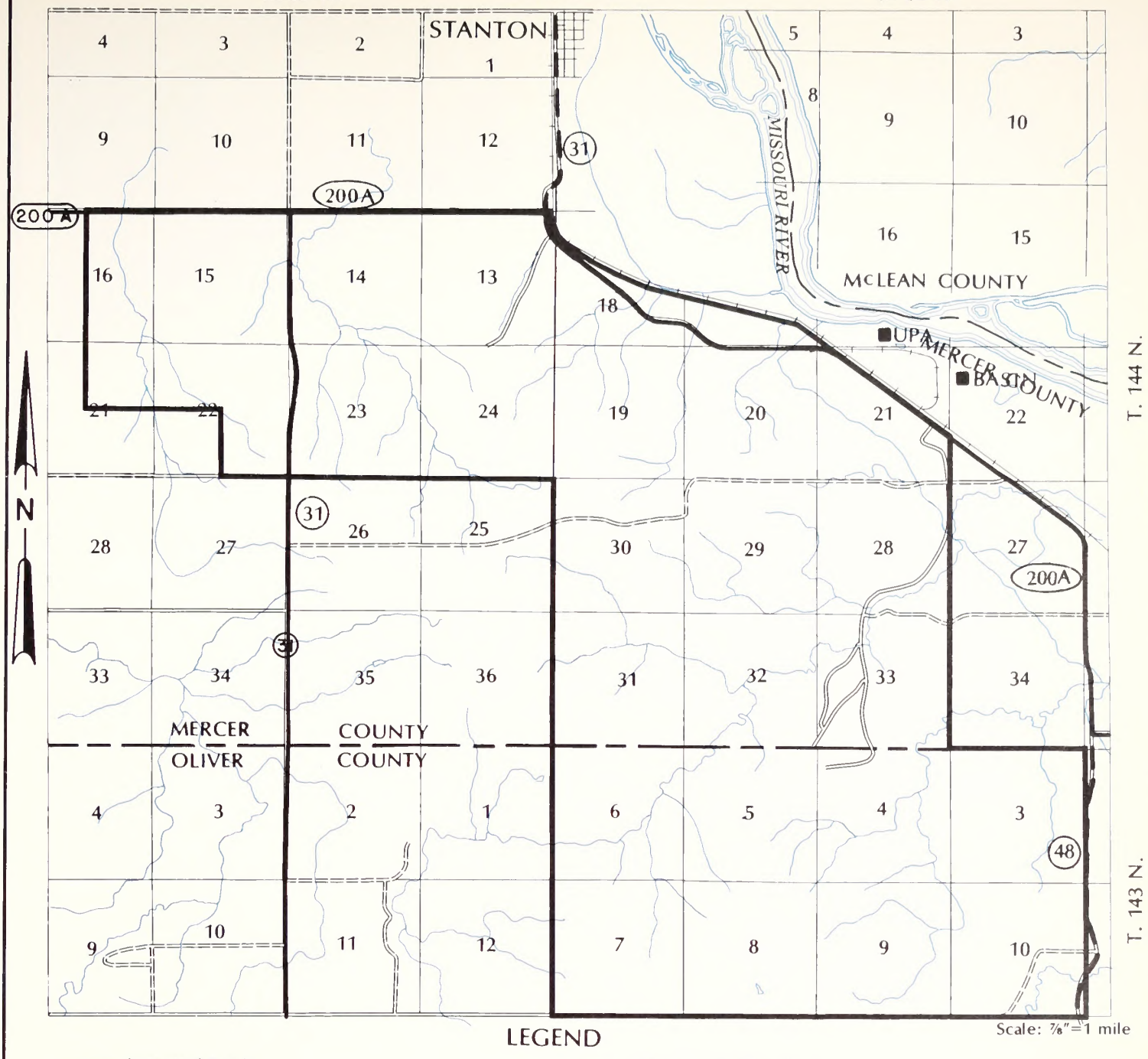
Oliver County enacted a zoning ordinance in May 1977. The eight sections of project area land in Oliver County are zoned Agricultural. The ordinance, similar to Mercer County's, would permit mineral exploration and mining in an Agricultural District as a conditional use.

Short-Term Application Area

The short-term application area is included in the above discussion of the existing environment. All of the short-term application area lies within Mercer County. There is one homestead within the short-term application area which lies outside of the proposed mining area. Acreages of land uses are shown in Table 2-20 of the Vegetation section. Highway 31 borders the short-term application area in Section 14, T. 144 N., R. 84 W., and Section 22, T. 144 N., R. 85 W. The only other roads which cross the short-term application area are mine haul roads.

Surface ownership of the short-term application area consists of Consolidation Coal Company and four additional private landowners. Surface ownership is shown in the Land Use Analysis. All of the short-term application area is county zoned for agriculture. Lot 4 and the SW1/4SE1/4 of Section 20, T. 144 N., R. 84 W., are zoned also for mining. (See Map 2-14.)

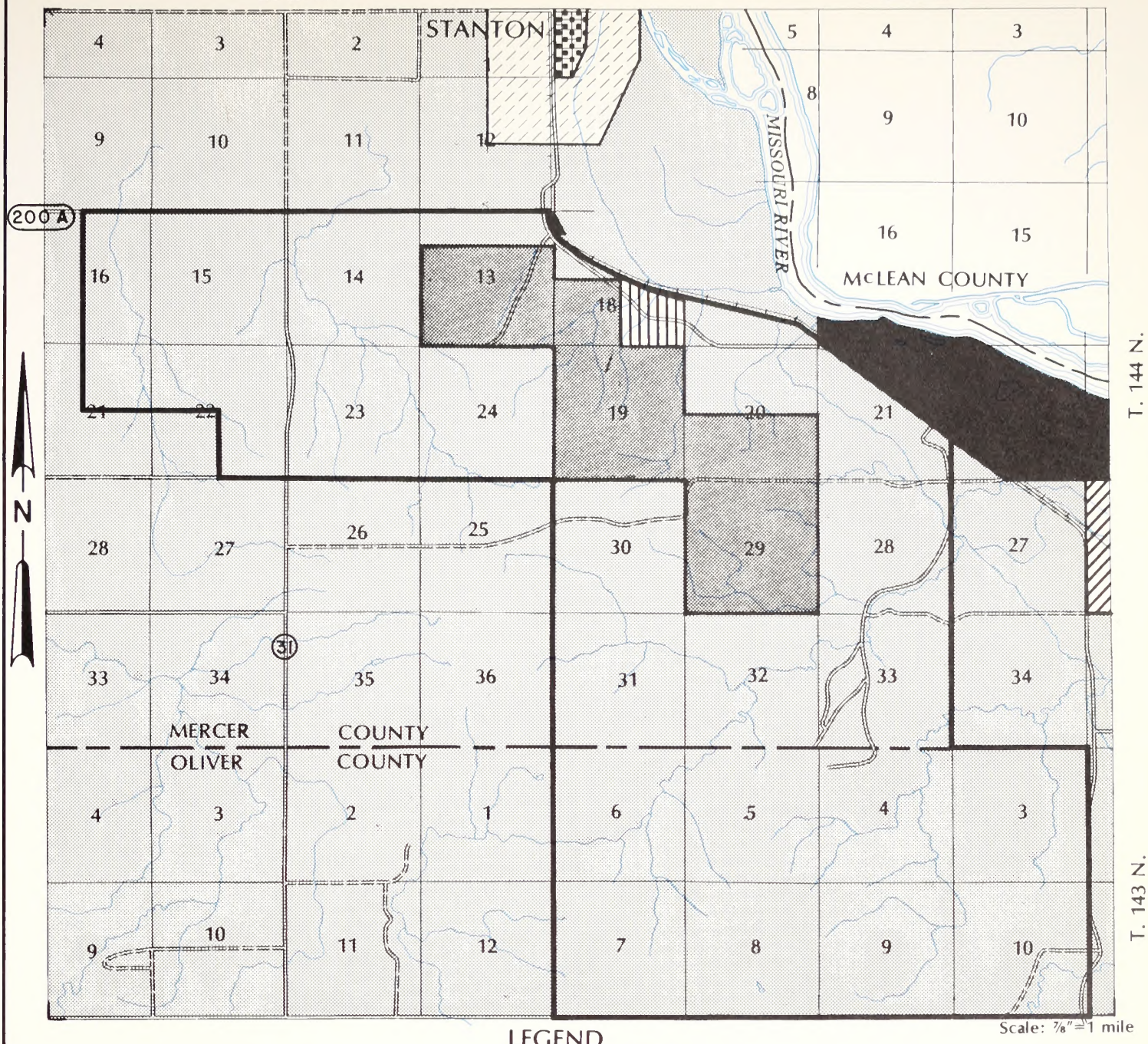
MAP 2-13



SOURCE: North Dakota Highway Department, 1977

TRANSPORTATION SYSTEM

MAP 2-14



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Residential
- Within Zoning Jurisdiction of Stanton
- Industrial (Includes Sec. 23 So. of River)
- Recreational (Secs. 25, 26, 36)
- Mobile Home Park
- Conditional Use Permit for Coal Excavation and Mining
- Agriculture

SOURCE: Mercer County Planning and Zoning Commission and Oliver County Planning and Zoning Commission 1977

ZONING STATUS

Chapter III

Environmental Impacts of the Proposed Action

CLIMATE AND AIR QUALITY

Project Area

Removal and stockpiling of the topsoil would destroy all vegetative cover, which normally shades and cools the land surface. The air temperature close to the ground would increase by an undetermined extent, and the flow of air would follow the new topography created by the overburden piles. General air movement patterns would not be impacted.

The post-mining rolling topography combined with the replacement vegetation would act as a buffer against microclimatic extremes of temperature and would facilitate the establishment of vegetative types suitable to the area. For some trees and shrubs, the shade modification of temperature may be critical for regeneration. The general air movement and air temperatures throughout the area would not be affected by the action.

Emissions

The influence of coal mining activities on the ambient air quality of the area surrounding a mining operation is shown in Table 3-1. Emissions from combustion of gasoline or diesel fuel in motor vehicles and heavy earth-moving equipment are minor. The major air contaminant from any mining operation is fugitive dust particulate. As shown in Table 3-1, a number of activities contribute to the total ambient air quality concentration of particulates in the area surrounding the mine site.

Since the Glenharold Mine does not propose to increase its mine production from the current level of 3.7 million tons per year, no increase in total particulate emissions or subsequent ambient air quality concentration is to be expected. Air quality impact analysis therefore involves a determination of the particulate ambient air quality currently surrounding this mining operation.

The North Dakota State Department of Health conducted a short-term study of the air quality in and around the Glenharold Mine between July 6, 1976, and August 6, 1976. All the activities described in Table 3-1 were underway at this time. Map 3-1 shows the location of the four sampling sites used. Total suspended particulate results of this sampling are shown in Table 3-2. These results indicate that the air quality surrounding the mine site is well within the air quality standards. High levels of particulate were found within the mine at Site A-2; however, the mining operations did not cause the ambient air quality standards to be exceeded outside of the mine proper.

The short-term ambient air quality study was performed during a period of low relative humidity and no rainfall. Mine production over this period of 32 days was 364,630 tons of coal or, if extrapolated over a year's production, 4.16 million tons of coal. Since the mine production is 3.7 million tons of coal per year and no rainfall occurred in this period, the study could be considered as a "worst case" analysis with the ambient air quality not being exceeded as a result of this mining operation.

Mine particulate emissions were computer modeled to determine expected contributions to the ground level annual geometric mean in the area surrounding the mine. As shown on Map 3-2, the expected off-site concentration would not appreciably be affected.

Short-Term Application Area

Should leasing occur in the short-term area, coal production would remain at the same level. Since the short-term application area lies scattered throughout the project boundary, climate and air quality impacts as a result of mining would be the same through 1998 as previously described.

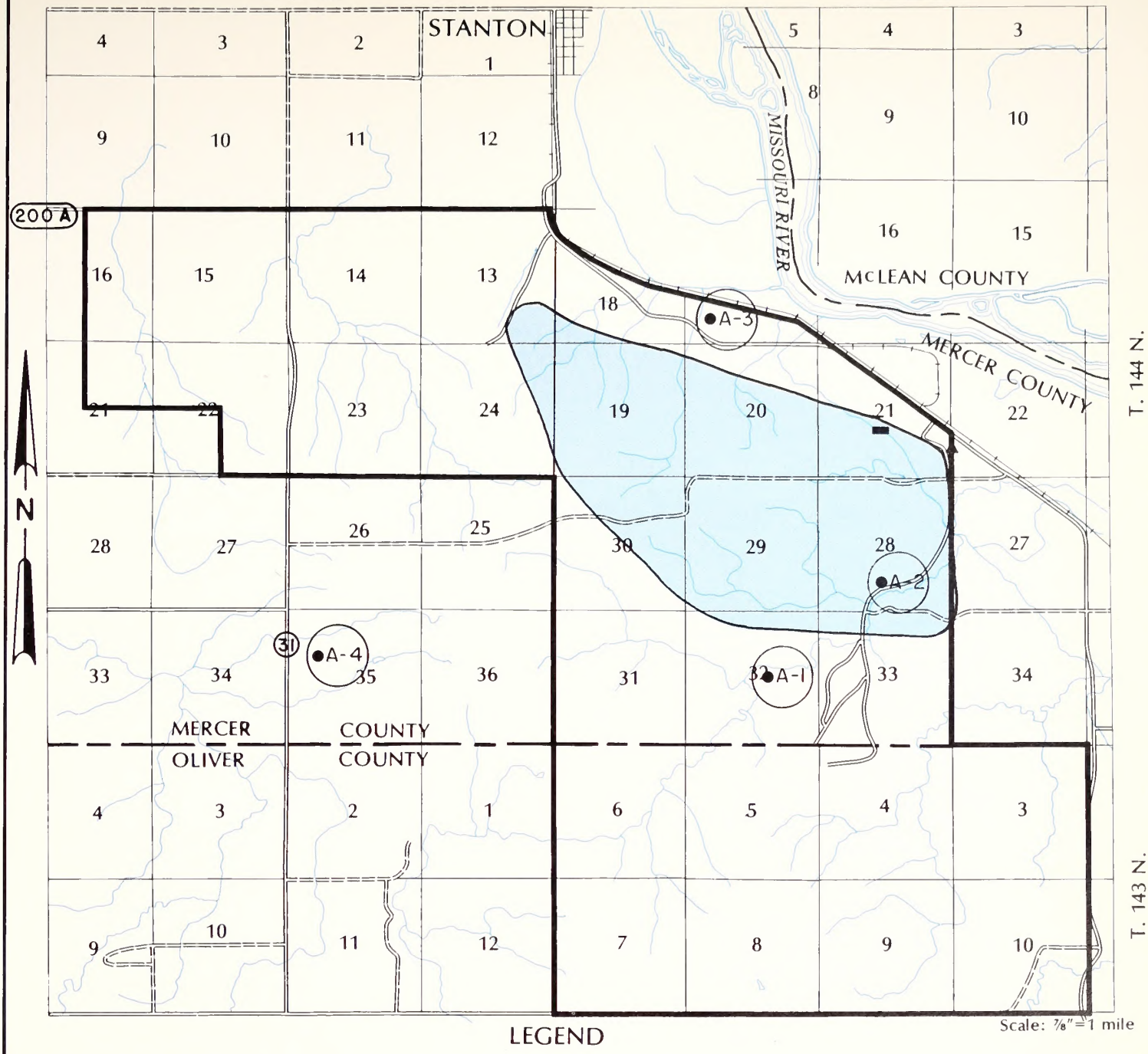
Impacts to climate and air quality would remain the same should the remaining unleased federal coal not included in the short-term lease area be leased at a later date.

TABLE 3-1

AIR QUALITY IMPACT OF COAL MINING ACTIVITIES

Activities	Impact
GENERAL MINING AND RECLAMATION ACTIVITIES	Minor air quality impact from increase in exhaust emissions from heavy equipment consuming gasoline or diesel fuel Contributes to the total air quality loading
EARTH MOVING	
Topsoil Removal Subsoil Removal	Contributes to particulate ambient air loading with areas actively worked and exposed to wind erosion prior to overburden and coal removal
Overburden Removal	Contributes to particulate ambient air loading with areas actively worked (dragline)
EARTH STOCKPILING	
Topsoil Subsoil Overburden	Contributes to particulate ambient air quality loading as a result of wind erosion of stockpiles
COAL REMOVAL	
Blasting Coal Removal Truck Loading	Minor contribution to particulate ambient air loading (power shovels and trucks)
COAL HAULING	
Haul Roads	Contributes to particulate ambient air quality loading as a function of haul road miles and condition of haul roads
COAL TIPPLE	
Truck Dump Area	Minor local problem in the tipple area. No major contribution to particulate air quality loading
Crushing, Loading, or Conveying	Contributes to particulate ambient air quality loading as a function of mine production and control or lack of control of emissions
RECLAMATION	
Overburden Leveling Subsoil Replacement Topsoil Replacement	Contributes to particulate ambient air quality loading as a function of surface area of mine involved in this activity at any one time
Cultivation and Seeding	Contributes to particulate ambient air quality loading as a function of surface area actively worked without vegetative cover

SOURCE: North Dakota State Department of Health 1976.



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Mine Office
- Stream
- Mine Tipple
- ● A–I Air Quality Monitoring Stations
- Area of Mining Activities, 1976

SOURCE: North Dakota State Department of Health 1976

AIR SAMPLING SITES FOR AIR QUALITY STUDY OF GLENHAROLD MINE

TABLE 3-2

TOTAL SUSPENDED PARTICULATE AIR QUALITY
IN AND AROUND GLENHAROLD MINE
(July 6, 1976, to August 6, 1976)

Sampling Site	Number of Samples	Micrograms Per Cubic Meter of Air			
		Maximum [1]	Minimum [1]	Arithmetic Mean [2]	Geometric Mean [2]
A-1	24	59	18	34	32
A-2	24	314	18	97	75
A-3	24	101	18	50	46
A-4	24	79	21	39	37

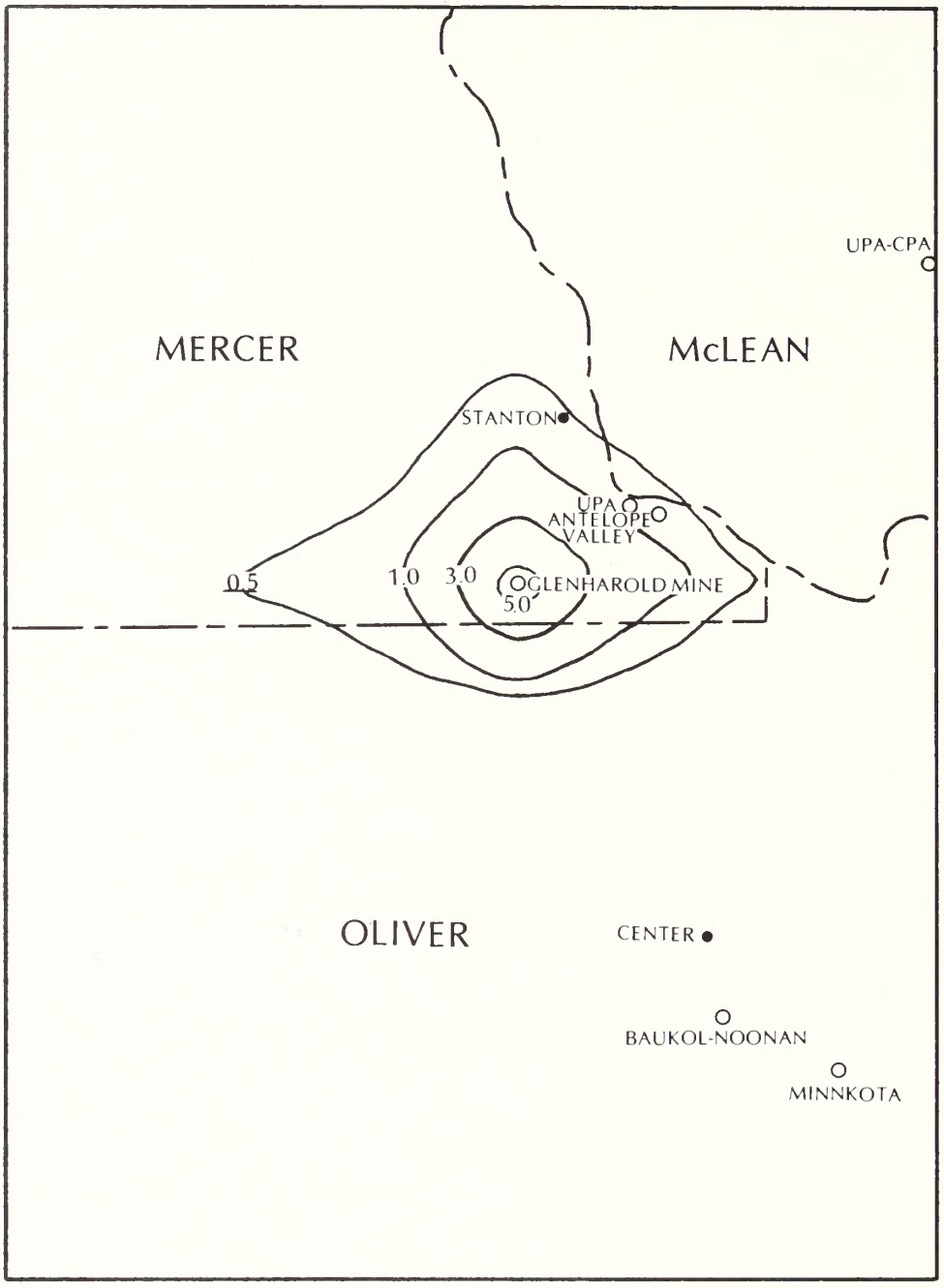
1/ Individual 24-hour sample. The North Dakota ambient air quality short-term standard for total suspended particulate is a maximum permissible concentration of 150 micrograms per cubic meter, maximum 24-hour concentration not to be exceeded more than once per year.

2/ Mean of all 24 samples. The North Dakota ambient air quality long-term standard for total suspended particulates is a maximum permissible concentration of 60 micrograms per cubic meter (annual geometric mean).

SOURCE: North Dakota State Department of Health 1976

MAP 3-2

PROJECTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS FROM GLENHAROLD MINE



Isolines show total suspended particulate concentrations in micrograms per cubic meter of air.

○ Plant and Mine Sites

● Cities

0 5 10

MILES

SOURCE: North Dakota State Department of Health, 1977

GEOLOGY

Project Area

Topography

The proposed company plan would continue in an active open-pit coal mine through and potentially beyond 1998. Outside the project boundary, the high walls, ramps, access roads, drainage ditches, spoil piles, and linear pits would gradually replace the natural slopes of the present land surface. The total area being stripped or covered by unreshaped spoils at any one time would be approximately 200 to 850 acres. At the end of the proposed mining period, the land surface would be more gently sloping. Stream valleys in the mined area would be obliterated and replaced by man-made drainages where necessary. The streams are ephemeral and their watershed upstream from the proposed mine area are small. (See Water section for more detail.)

Topography of the mined area would be modified due to removal of natural irregularities including small tributary valleys and replacement with a man-made surface. Reshaping includes grading the spoils to a gently rolling surface and establishing drainage patterns consistent with the surrounding area. Slope gradient and drainage would conform to approximately the contour of the original surface, or a grade which is less than the angle of repose. High walls would be graded to uniform slopes and the final cuts would be drained.

Objectives of reclamation include the rehabilitation of the mined land upon termination of the operation so that the land would be stable and be capable of being utilized for the same activities as before mining.

A concern is whether the volume of spoil replaced throughout the mine site would be more or less than the undisturbed volume. An approximate value for the amount of expansion as bedrock is converted to spoil is 20 to 25% in this area. Coal removed is expected to be about 17 feet thick. If the average thickness of the overburden is 85 feet, the average thickness of the final fill would be 102 to 106 feet. If this estimate is correct, the volume of material returned to the mine site would be equal to the total volume removed and the approximate original topography may be reconstructed. Subsidence or compaction of the spoil returned to the pits is not expected to be significant. Differential compaction of the spoil material may produce local "piping" at the land surface, however, as described in Soil section of this chapter.

Stratigraphy

Strip mining of coal in the project area would destroy the layering, compactness, and cohesion of the bedrock from the base of the lowest minable coal seam to the base of the soil zone. A strip mining operation generally brings deeper overburden near the surface. In the project area, drill core studies (Sandoval et al. 1973) indicate that the overburden immediately above the coal to be mined is rich in clay and has a higher sodium adsorption ratio than the shallower overburden. These physical and chemical properties of the deeper bedrock strata indicate that raw spoil from them would not be suitable for vegetative growth.

By the year 1999, about 3,547 acres of bedrock (overburden and interburden) would be excavated and converted to spoil; about 1,385 acres of that could involve federal coal should the remaining strippable federal coal be mined. The chemical reactivity of the spoil material would be increased because of the increase in volume (20 to 25% greater than the undisturbed bedrock) that would result from the overburden removal and replacement.

Minerals

Mining of 3.7 million tons of coal per year until 1999 would result in total production of 98.6 million tons of coal to be consumed in generating electrical power. About 26.4 million tons have been mined to date. Recovery is estimated at about 85%, so about 116 million tons of coal reserves would be committed to that production for the total life of the project area. The amount of coal in thinner beds that would be cast into the spoil along with the overburden has not been calculated, but if it is assumed that one-half of the 5,525 acres to be mined contains an average thickness of one foot of nonrecoverable coal, then about 4.8 million tons of coal would be destroyed during overburden removal and thus lost forever to future use. The total coal resource committed to the project would probably be in excess of 120.8 (116 plus 4.8) million tons.

North Dakota coal slacks (crumbles to small particles) readily on exposure to air. This creates a potential for spontaneous combustion (self-ignition in the presence of air). Exposure of the coal beds during the mining operation would also increase the potential for ignition of the coal by range fires,

random lightning strikes, or the activities of people. Uncontrolled burning of coal would destroy some of the coal resource, cause smoke pollution to the atmosphere, and interfere with the mining operation.

An unknown amount of sand and gravel would be used in construction of four additional truck bays and two highway underpasses. The sand and gravel would probably come from nearby quarries.

Clinker would be used as subgrade and surfacing material in construction of an unspecified length of new haul roads. The 80 foot width of haul roads would probably require 32,000 cubic yards of clinker for each mile of road.

Fossils

Fossil material may be uncovered that would be of scientific or economic value. The study of fossils from North Dakota has resulted in fuller understanding of the environmental conditions that resulted in the formation of the coal (Royse 1971). The mining and quarrying operations would obliterate the geologic relationships of any fossils contained in the overburden, the coal beds, and the construction materials. Burning of the coal would destroy its contained fossils.

Short-Term Application Area

Effects to topography from mining would be similar to mining the remaining private coal within the project boundary as discussed earlier. Physical mining would occur on about 983 surface acres or 59% of the surface identified in the short-term application area if leasing occurs. Surface disturbance within the application area would represent 45% of the remaining private coal, or 28% of the total private and federal areas that could be mined.

The remaining 291 minable acres overlying federal coal not included in the lease application area represents about 8% of the minable surface area within the project that could be mined. The minable surface area of the application area would be modified by replacing natural irregularities with man-made surface.

Approximately 983 acres of overburden and interburden would be converted to spoil bringing the deeper overburden nearer the surface. The projected disturbance represents 28% of the total private and federal coal that could still be mined. Overburden immediately above the minable coal is rich in clay and has a higher sodium absorption ratio than the shallower overburden.

Approximately 17.8 million tons of recoverable coal are available for mining within the application area. This represents 25% of the remaining recoverable coal estimated to exist within the project boundary. Assuming an 85% recovery rate and at least one foot of non-recoverable coal for half the minable acreage, 21.8 million tons of coal would be committed to mining and use. About 4 million tons would be lost during mining.

Paleontologic resources would be damaged or destroyed on approximately 983 acres should mining occur in the lease application area.

SOILS

Project Area

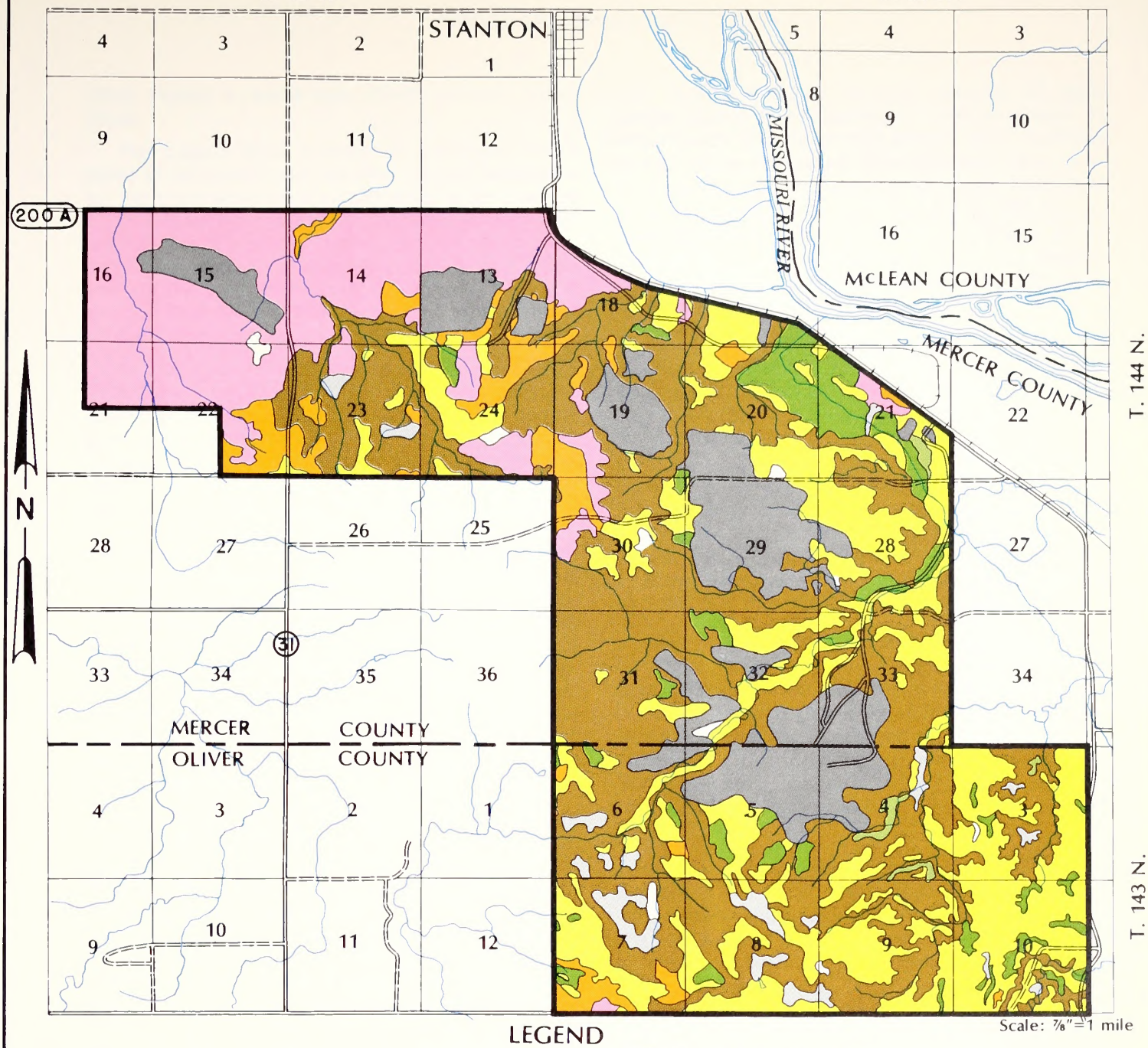
Soil impacts of the proposed strip mining activities in the project area would include wind and water erosion (during the timespan of stripping the topsoil until it is replaced and revegetated), disruption of agricultural productivity, subsidence and piping from uneven compaction in respreading of overburden materials, and fugitive dust from haul roads. Significant impact concerns are shown on Map 3-3.

Impacts associated with water erodibility hazard have the greatest significance. Of the coal reserve area, 66% has high to very high water erodibility. In the northern sections of the strippable coal reserve area, soils with severe wind erosion hazard, comprising some 23% of the area, are an added concern in revegetation. Reclamation of national prime farmland also has been expressed as a significant concern. Sodic materials with minimal suitable plant growth material for cover extend in scattered tracts across only 181 acres of the strippable coal reserve area.

The major impacts on soil from the proposed Consolidation Coal Company Glenharold Mine project would result from soil disturbance in the surface mining of coal. For the mining operation, four phases of activity are involved: (1) exploration, (2) mining, (3) overburden and topsoil storage, and (4) mined land reclamation.

The exploration phase of the proposed action could have minimal short-term consequences in soil compaction, reducing plant root penetration and seedling germination, and erosion of topsoil from

MAP 3-3



Scale: ⅞"=1 mile

LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream

- Sodium affected soils 0–20" suitable plant growth material
- Saline lowlands
- National prime farmlands
- Severe wind erosion hazard
- High to Very High erodibility
- Severe wind erosion hazard and high to very high erodibility
- Disturbed land
- Areas of minimum mitigation concern

SOURCE: Pointer 1977

Note: Based on Soil Conservation Service Data

IMPACT CONCERNS

steep slopes in areas over which vehicles would travel.

The project area involves an estimated 3,547 acres of strippable coal reserves. Annual expansion for the Glenharold Mine is estimated at an average of 155 acres over the life of the project, with total annual disturbance estimated at 211 acres. The estimated amount of disturbed land in any given year for the project ranges from 775 acres to 1,055 acres. These estimates include acreage involved in rehabilitation, haul roads, and equipment storage.

In mining, the overburden is removed and piled by draglines in rows of spoil piles. These piles are then regraded by bulldozers. Generally, the central axis of the pile tends to have the most compact material with less packing on the outslopes. Regrading tends to place even less dense material between spoil pile rows. The patterned differential in density of spoil material could produce uneven subsidence, or slumping, and result in differences in surface drainage. The respread spoil material has generally been estimated to experience a 20 to 25% expansion in volume; with a patterned differential of spoil material, a subsurface channeling of water flow (called piping) could create linear subsurface caverns, especially in the fine textured materials predominant in the overburden. The surface would be unstable, and cave-ins of several cubic feet of material would be possible, creating hazards to man and animals.

Strip mining generally brings deeper overburden near the surface of spoil piles. Unweathered material, much of which in the project area is high in sodium and of a fine clay texture, would be left at the surface of the spoil piles. This material is susceptible to wind and water erosion when left bare for extended periods of time, allows low rainfall penetration, and tends to form crusts which interfere with seedling germination. Water erosion losses from bare overburden, because of swelling and shrinking properties associated with high sodium contents, have been found to be less than those losses estimated in Chapter 2 for comparable topsoil (Reclamation Research Staff 1977). Wind erosion losses are estimated to be slightly higher, however.

In a worst case situation, 211 acres would be bared--and therefore subject to wind and water erosion as discussed in Chapter 2--for a maximum of one year. Water erosion losses, from rocky shaley subsoil on 16% slopes of a 300 foot length, could, in the worst case, amount to 118 tons of material per acre per year; however, application of mining and reclamation stipulations would considerably reduce erosion losses. Within the strippable coal reserve area, 50% of the soils lie on slopes greater than 9%, and 66% of the area has high to very high topsoil erodibility hazards. Creation of more gentle slopes would particularly reduce erosion in these areas. Clay soils with severe wind erodibility hazard could, in a worst case situation, lose up to 51 tons of topsoil per acre per year with 1,000 feet of linear exposure to wind. Losses of this magnitude might be possible from the exposure of sandy loam areas in the northern sections of the strippable coal reserve area. These potential hazard areas comprise about 23% of the area.

The proposed mine area contains 17% Class II lands, 11% Class III lands, 13% Class IV lands, 21% Class VI lands, and 38% Class VII lands. Although other land uses occur within the proposed mine area, native grazeable resource data was used as a consistent base for productivity analysis. Based on average productivity estimates of 1,787 pounds of dry forage per acre per year, as calculated in Chapter 2 for the proposed mine area, the annual mining disturbance of 775 to 1,055 additional acres would result in an annual short-term loss of 1,385,000 to 1,885,000 pounds of forage.

One hundred ninety-six acres of national prime farmland lie over strippable coal reserves. Based upon ongoing mining and reclamation on national prime farmlands in the Glenharold project area, premining productivity levels are expected to be restored by land reclamation in accordance with the Surface Mining Control and Reclamation Act and North Dakota Public Service Commission stipulations.

In mined land reclamation, spoil piles are regraded to the most gentle topography consistent with existing topographic contours. Within 34% of the coal reserve area, lessened slopes could result in higher agricultural productivity from increased water infiltration.

Over this reshaped overburden, the separately stored subsoil is then respread, followed by respreading of the separately stockpiled topsoil. As in the initial phase of overburden piling, the respreading operations could result in uneven compaction due both to equipment and differential density of the respread material, indicated in the earlier discussion of subsidence and piping.

Surface landowners have the option of requiring topsoil from their acreage to be placed on their own land without mixing of soils between areas of different ownership, thus limiting the capability of respreading the topsoil to uniform depth.

In establishment and maintenance of haul roads, fugitive dust and soil compaction are primary impacts. Unpaved roads contribute 75% of existing particulate air emissions in Mercer County.

Short-Term Application Area

Within the short-term application area, a total of 983 acres would be disturbed at an average annual rate of 211 acres. Productivity disturbance would be greatest on 53 acres of national prime farmland. Losses on these lands, for the 3-to-5 year reclamation period, would amount to an annual equivalent of 2,275 pounds of forage per acre. Total annual productivity interruption for 211 acres would amount to 377,057 pounds. Based upon ongoing mining and reclamation on national prime farmlands in the short-term application area, pre-mining productivity levels are expected to be restored by land reclamation in accordance with the Surface Mining Control and Reclamation Act and the North Dakota Public Service Commission stipulations.

Sodium affected material is not of significant concern.

Subsidence and piping would be of significant concern throughout the area.

Suitable plant growth material is limited in significant areas of sections 24 and 30. More detailed soil mapping is necessary to determine the feasibility of reclamation in these sections.

WATER

Project Area

Consumptive water uses associated with the mining are relatively small. Water is used for dust control on haul roads and at the tipple, for washing equipment in the shop area, and for personnel needs. Most of the water used on the haul roads is evaporated. The remaining water is retained by the fragments in the roadbed or becomes runoff to the mine or the reclaimed spoil. Wash water from the tipple or the equipment carries sediment and soluble material and may acquire oil or grease from the machinery. These impacts would continue as long as mining continues.

Surface Water

Mining would have minor impacts on the surface drainage areas. Drainage divides would be shifted laterally with reshaping of the land surface. The movement of the divides would amount to a few tens of feet, with possibly a few hundred acres being placed in a different drainage. The net result would likely be negligible.

Annual runoff would not be changed significantly by mining. None of the existing ponds would be destroyed. The ephemeral streams that drain the Glenharold Mine area would be realigned in places, but their overall drainage area and steepness of slope would be relatively unchanged. Erosion and transportation of sediment would increase because of the disturbance of the land surface that feeds water into the streams. New gullies in disturbed soil and spoil would concentrate and increase runoff and would be susceptible to erosion. Increased sediment removal would continue until the vegetative cover could be re-established. The salinity of the surface runoff may increase slightly until rehabilitation is completed.

Ground Water

Ground water that presently seeps along the hillsides from the shallow lignite or sandstone strata would no longer be available. The spoil initially would be more permeable than the unmined strata. Where seepage has sustained a line of vegetation or a hardwood draw, the water supply would be interrupted and the vegetative community might be lost. The water would tend to collect in the lower part of the replaced spoil. If the slope of the mine floor is toward a hillside, a new seep or spring may emerge and provide water for a hardwood draw at a lower site. If the slope of the mine floor is toward the unmined lignite, the accumulating water would be more likely to become ground-water recharge to the lignite than to become seepage to the hillside.

After topsoil emplacement and before growth of new plants, soil moisture deficits would be satisfied with the first rains or snowmelt. Subsequent rain during this time could become recharge where the soil and spoil would let it pass through. Much of the spoil would be shale or sandy shale that would form a tight clay, however, and would prevent downward movement of water. The water would become surface runoff or seepage to stream valleys or to ponds.

The influence of mining on ground-water supplies would be negligible. Glacial outwash does not overlie the areas proposed for mining, and the deeper aquifers would not be touched by the proposed strip pits.

Water may move downward through the spoil and increase the salinity of the ground water. This effect would be limited principally to the mined area and would be limited vertically by the base of the

mined lignite beds. Water would accumulate in the rubble in the base of the replaced spoil until it found an overflow point, which might be a permeable zone in the adjacent unmined rock or the edge of a hillside.

The volume of the replaced overburden (spoil) would be about 120% of the original volume. The "expansion" is from voids produced when earth materials are broken, mixed, and replaced. The voids constitute a potential storage area for ground water.

Short-Term Application Area

The foregoing impacts on water resources apply to both the project area and the short-term application area. There would be no significant variations of the impacts; only an increase in the areal extent of about 980 (actually minable) acres.

VEGETATION

Project Area

During the mining operation, vegetation would be removed, crushed, compacted, and otherwise damaged or destroyed by vehicular traffic and excavation. This disturbance of the vegetative land cover would amount to approximately 4,220 acres. These figures are estimates based on an average of 155 acres per year being mined with a total land disturbance averaging 211 acres per year over the estimated life of the project.

Other destruction and damage to vegetation would occur as a result of vehicles and equipment compacting soil, mechanically breaking down crops and woody plants, clearing away vegetation for drilling machinery, and piling drill core wastes on vegetation surrounding the drilling sites. Unless the soil is extremely wet as in early spring or extremely dry as sometimes in late summer, these impacts should be temporary. This would not be true if equipment were operated on growing crops or if heavy traffic would be generated in a localized area such as where an access road is being built. Crops that have been driven on may not recover that year.

The dust and equipment emissions would normally create impacts of minor importance unless concentrated for extended periods of time. If drill core wastes are not properly disposed of, they could create long-term impacts. These impacts would be in the form of high sodium wastes from overburden being left on the surface. Soils with a high sodium content tends to inhibit plant growth.

Trees that are crushed or uprooted would not recover and would probably take a considerable amount of time to be naturally replaced. Mechanical breakage of trees would weaken the plant and increase their vulnerability to disease and insect infestations.

Cropland

There would be a direct disturbance of 663 acres of cropland over the 20-year life of the project. This translates to about 33 acres per year being taken out of production or an average of approximately 165 acres of cropland being out of production at any one time after the first five years (assuming five year reclamation). Normally, wheat is grown on a given acreage for 3 out of 10 years and yields 22.5 bushels per acre. The average annual loss of wheat production would be about 743 bushels or about 14,860 bushels over the life of the project. Smaller amounts of less extensively grown crops would be lost each year over the life of the project, after the first five years.

As noted in Table 2-10 in the Soils section of Chapter 2, approximately 682 acres within the project area and 193 acres within the proposed mining areas are designated as national prime farmland. About 3,717 acres in the project area and about 654 acres within the proposed mining areas are designated as agricultural land of statewide importance.

High local ambient dust concentrations over an extended period would cause grain and grass crops to have stunted growth and lowered production. This effect can be observed during the growing season along gravel roads throughout much of North Dakota. The continual coating of dust on the leaf surface of plants will tend to clog leaf surface openings (stomata) and decreases photosynthesis by blocking out sunlight. These impacts would probably be minor in nature and would be greatly alleviated by road watering and by immediately beginning reclamation after mining has occurred.

Stockpiles or spoil piles invaded by noxious and/or annual weeds would offer a place for the weeds to grow and produce seed which would then be disseminated to nearby agricultural land.

Exhaust emissions would likely have little effect on plant health but, coupled with the ambient dust

from haul roads and emissions from power generating plants in the vicinity, they would stunt or kill the vegetation in localized areas.

Impacts on crops from reclamation operations include those mentioned above plus further invasions of the weeds, grasses, etc., that were used to stabilize soil stockpiles or invaded the stockpiles. Wind and water erosion on respread areas, sodium toxicity, crusting as a result of mixing soils, and percolation from mixed subsoil would also impact crops. These impacts would be of minor concern except in areas with high sodium spoils and shallow topsoil depth as delineated in the Soils section.

Native Prairie

About 81% or 2,877 acres of the proposed mining area consists of rangeland or native prairie. This amounts to 1,384 acres of grassland, 881 acres of shrubland, and 612 acres of woodland. Most of this acreage would probably be mined during the life of the project. The project area consists of about 10,200 acres of rangeland. In addition to the acreage disturbed by the proposed mining areas, another 620 acres on the project area, would be disturbed during the life of the project for soil stockpiles, haul roads, and equipment storage.

Impacts resulting from exploration and reclamation operations on grassland would be similar to those discussed under croplands.

Mining would, over the life of the project, destroy about 1,384 acres of native grasslands plus an associated 881 acres of shrubland. Original native grassland communities cannot be re-established using current technology. The reasons for this are the lack of a seed source for many of the grass and forb species and the difficulty of getting many of the species established under domestic conditions. However, it is likely that a mixture of grasses that would produce the current amount of forage could be re-established within three to five years. Native grasslands are important for livestock grazing, wildlife habitat, and aesthetic resources and because they provide better quality season-long grazing than domestic grasslands (Galt 1977).

Native grasslands generally have more livestock grazing and wildlife habitat utility than reseeded rangeland because of the diversity of species on the native range. If reclaimed rangelands with a composition of cool season grasses were used in conjunction with native rangeland, the livestock grazing operation may be more productive than if either range were used separately (Ries 1977). However, wildlife habitat utility would be less. Reclaimed, cool-season range could be used spring and early summer, and the native range could be utilized in late summer and fall. This would give more total production for livestock forage than by using only native range.

Grasslands adjacent to haul roads and soil stockpiles would be impacted by fugitive dust, exhaust emissions, clearing, sedimentation from erosion, and invading or introduced species. High concentrations of fugitive dust and exhaust emissions can detrimentally affect plant metabolism.

Exhaust emission, dust particulate, and drill core wastes will have similar impacts on shrub communities as discussed previously. Vehicle and heavy equipment traffic impacts would be greater due to the woody nature of shrub species. Crushing of shrub species could result in more severe damage to the plant. This impact could be beneficial as well as detrimental, depending upon species' rejuvenation characteristics. Older, stagnated plants might be rejuvenated as a result of crushing, while younger plants would be damaged as a result of loss in stem and leaf area. Other shrubland would be impacted by haul roads and soil stockpile areas as discussed previously.

During the life of the project, mining would destroy about 881 acres of shrubland in the proposed mining areas and an estimated additional 130 acres in the project area adjacent to the mining areas. Current research on the reclamation of shrublands is inconclusive since, as far as is known, no one has yet reclaimed mined shrublands back to their original state. Encouraging results were reported by Kissel and Whitman (1976) on experiments in growing some shrub species on mine spoils in western North Dakota. However, more research would be required to estimate the time required to reclaim a native shrubland to its original state. It should also be considered, with shrubland as well as grassland, that the surface owner's choice may not include reclaiming the land to its original use. He may request that the spoils be reclaimed to a more economically productive use such as cropland.

Impacts resulting from reclamation operations, such as loss of vigor, might be experienced from high dust concentration. Deposition from wind or water of highly sodic material around the shrubs would reduce growth and vigor as would soil compaction and breakage by mining related activities and equipment.

Woodlands

Impacts from exploration operations in woodlands are similar in nature to those discussed in

previous sections; however, they would be more severe due to the woody nature, slower growth, and closed canopy of woodland species.

Mining would probably destroy most of about 612 acres of native woodlands in the proposed mining areas and could affect an additional estimated 140 acres in the project area outside the proposed mining areas. The project area contains about 2,039 acres of woodlands, most of which are in hardwood draws.

Current research on reclaiming woodland is inconclusive, but there are some indications (such as good tree growth on spoils at the Custer and North Beulah Mines) of potential reclamation of woodlands (Gwynn 1965). Due to the slow growth and soil moisture requirements of woody species, 30 to 50 years or more may be required to reclaim woodlands. Even though woodlands might be reclaimed, reclaiming hardwood draws to their original state is questionable.

Impacts from reclamation operations include invasion of weeds, grasses, etc., from soil stockpiles; wind and water erosion during reclamation; sodium toxicity, crusting resulting from mixing soils, percolation from subsoils; and concentration of available soil moisture along drainages after mining. All of these could create a less desirable environment for growth and limit woody plants' survival potentials.

Water Surface

Four of the 17 intermittent stockwater ponds within the project area are within the proposed mining areas. Mining should therefore have no significant impact upon the aquatic species of the ponds.

Mined Lands

These areas have already been disrupted by mining. The vegetation has been stripped and the soil has been severely disturbed. Reclamation is ongoing and in various stages. Reseeding has occurred on about 532 acres. Heavy concentrations of dust from spoil piles and haul roads could have a detrimental effect on mined land vegetation. The vegetation would already be under abnormal stress from being grown on soil that has been severely disrupted through mining; any effects accrued to unmined land would be even more severe on mined land.

Other effects of mining such as compaction of soil by vehicles and equipment and mechanical breakage of woody plants and other plant types would apply on mined land as on other land.

Rare and Endangered Species

There are no rare or endangered plant species known to exist within the project area. One species, the largeleaf pondweed (*Potemogeton amplifolius*) is described by Barker et al. 1976 as being unique in North Dakota and has been noted in Oliver County; however, none is known to occur in the project area.

Short-Term Application Area

Impacts resulting from the proposed action of leasing the short-term application area are included in the preceding discussion of the project area and the proposed mining areas. No additional impacts would occur as a result of haul roads or other mining operations other than the disturbance of an estimated 20% or 197 acres of the proposed mining areas to be used for soil storage areas. Total estimated vegetation would be approximately 1,180 acres of which 319 acres of croplands, 459 acres of grasslands, 241 acres of shrublands, 159 acres of woodlands and 2 acres of water surface would be destroyed by mining. These acreage losses would amount to an estimated equivalent loss of 1,436 bushels of wheat and about 230 animal unit months of livestock forage annually, in addition to wildlife habitat losses as discussed in the Animals section.

ANIMALS

Project Area

A total of 3,547 acres of habitats of various types would be totally disrupted by strip mining or some type of construction at one time or another during the life of the project area (Table 2-18). Virtually all the animals on these acres (including even most of the insects and other small invertebrates) would be displaced or killed. Many animals, such as pocket gophers, earthworms, and thirteen-lined ground squirrels that hide in their burrows, would be killed. Others that are more mobile would

escape into the surrounding habitat. Fugitives would include red-tailed hawks, mule deer, and white-tailed jackrabbits.

The net result to local populations of these species, however, is the same whether or not individual animals are killed. Surrounding habitats are either at their current carrying capacity for the species involved or soon will be. The reproduction rates of wildlife species are so high that a literal "population pressure" is created that prevents suitable adjacent habitats from remaining vacant. Even species with relatively low reproductive rates, such as antelope, will fully occupy large areas of suitable adjacent habitat within a very few years. Observations to the contrary merely indicate that some necessary habitat component (water, freedom from excessive human disturbance, etc.) was missing. Thus, wildlife losses are directly proportional to habitat losses and are not reduced by the availability of adjacent habitat to which individual animals can escape.

The most significant impact on wildlife in the project area, even with timely reclamation, would be the disruption or change in the complex vegetative ecosystems comprising the various habitat types of the Missouri River breaks (Figure 3-1). Big game, upland game birds, and furbearers requiring diverse habitat types at varying stages of maturity and vegetative productivity would be faced with adapting to "artificial" habitats. Present productivity, in terms of pounds of forage per acre, might be attained within three to five years through reclamation to a fast growing grass or agricultural crop. However, the quality and quantity of forage and plant species diversity and distribution comprising the present ecosystem would take many years to regenerate. Significant impacts on wildlife species not able to adapt readily to these "artificial" habitats could be expected. For example, declines in deer, upland game birds, numerous non-game birds, and some furbearers may be measurable for 20 years or more. Conversely, field mice, raptors, coyotes, and non-game birds such as horned larks and English sparrows adaptable to "artificial" habitats could be expected to increase in the short term (one to five years after reclamation).

Since the probable mining area (overlay No. 1, Map 1-2) is largely within the Missouri River breaks where the amount of woodlands and shrublands is much greater than in Mercer and Oliver Counties as a whole, impacts to wildlife in general and game species in particular would be greater in the project area than they would be virtually any other alternative site in the vicinity.

Impacts beyond the life of the project (after 2005) will depend upon successful habitat restoration, particularly of woodlands, and landowner decisions on post-mining land use. Both factors could extend the wildlife impact described indefinitely into the future.

Domestic Animals

Assuming that no more than 144 acres of rangeland are taken out of production in any one year and that no land is out of production for more than five years, 720 acres of rangeland could be out of production at one time, potentially displacing 324 animal unit months per year based on potential forage production of range sites.

Some land taken out of production would not be mined. This would include parcels of land isolated from the surface owner's farming operation by the mining process and areas fenced out to keep animals away from the mining operation.

The probability of anthrax occurring in domestic animals as a result of the proposed mining in the project area is virtually impossible to determine, but is likely very low. Anthrax has not been associated with existing mining and ongoing farming operations in the project area (Flagg 1976 and Hastings 1976, personal communications).

The incidence of blackleg, malignant edema, and associated spore diseases in cattle and sheep could be increased due to continual disruption of the soil. However, economic losses from these diseases should not be increased since most ranchers and farmers in the area routinely vaccinate against them.

Dust from strip mining, haul roads, and other sources can irritate the eye mucosae and cause watery eyes and inflammation, particularly in cattle and sheep. Dry and dusty conditions also contribute to a form of pneumonia in these animals. This should not occur often except in periods of drought or high winds, or in areas adjacent to haul roads. A rancher might have to remove livestock at times from roadsides to avoid dust (Kimberling 1976, personal communication).

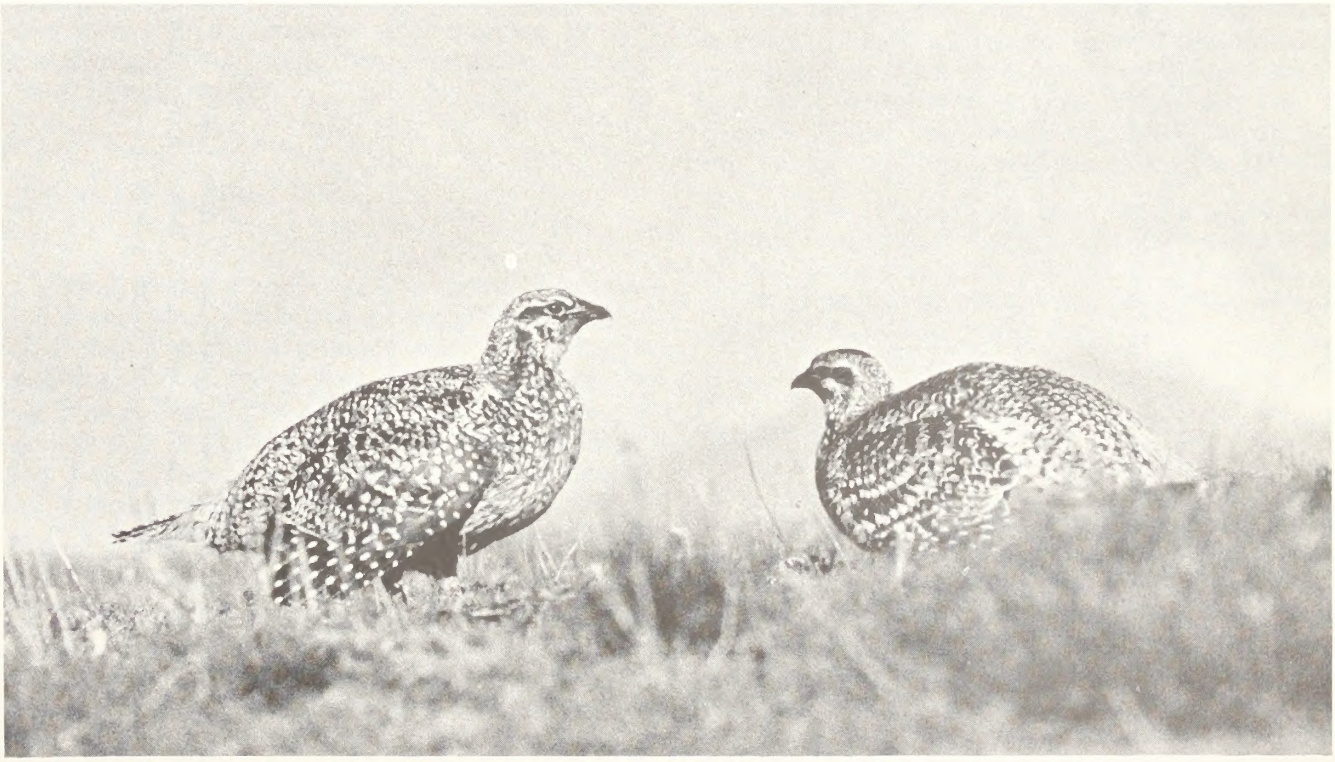
Big Game and Upland Game Birds

Habitat destruction, particularly the loss of woodlands and shrublands, and continued disturbance from humans would lead to significant reductions in most big game and upland game bird populations (Figure 3-2) on the project area. By 2005, the populations of most game species on the project area would be reduced by about 50% due to mining (Table 3-3). The return of game populations to pre-mining numbers would depend upon the suc-

Figure 3-1

Mining in the Missouri River Breaks. The impact to wildlife of mining in the intermingled woodland, shrubland, and grassland habitats of the breaks is more severe than almost anyplace else in North Dakota.

SOURCE: Bureau of Land Management



Sharp-tailed Grouse. This and most other game species in the project area would be reduced by about 50% in 2005.

Figure 3-2

SOURCE: North Dakota Game and Fish Department

TABLE 3-3

ESTIMATED POPULATION CHANGES FOR UPLAND GAME BIRDS AND BIG GAME
WITHIN THE GLENHAROLD PROJECT AREA WITH AND WITHOUT CONTINUED MINING

	Current (1976) Estimated Pop. Density (animals/mi^2)	Estimated 1976 Total Spring Population on Project Area (density x 20 mi^2)	Est. 2005[1/] Pop. Density (animals/mi^2)		Estimated Total Pop. on Project Area in 2005 With Cont. Mining	Estimated Annual Loss
			Without Cont. Mining	With Cont. Mining		
Mule Deer	0.25	5		0.15	3	2
White-tailed Deer	5	100		2	40	60
Antelope	0.05	1		0.05	1	0
Sharp-tailed Grouse	8	160		4	80	80
Pheasant	10	200		5	100	100
Hungarian Partridge	6	120		3	60	60
Wild Turkey	1	20		0.5	10	10

1/ According to the mining plan, mining will have ceased and the newest reclaimed spoils will be five years old by 2005.

SOURCE: Trego 1976, personal communication. Although these estimates are not based on on-site inventories, the Animals Work Group for the Regional Study believes them to be reasonable for the project area as a whole.

cess of reclamation and the adaptability of game to the (artificial) reclaimed habitats.

Waterfowl and Shorebirds

Impacts on waterfowl and shorebirds would be minimal. About nine acres of surface water occur within the probable mining area, mostly stockwater ponds. The largest is a 5-acre pond in Section 31. These ponds are used by migrating waterfowl and may produce 10 to 15 birds to flight stage annually. This use and production would be at least temporarily lost if the ponds were mined.

Furbearers

Furbearers would suffer population losses from habitat destruction. Significant losses would not be expected to extend beyond the areas of habitat disturbance. Higher than normal small mammal populations that sometime occur during early successional stages of reclamation (Sindelar et al. 1974) may benefit some species such as the fox. It is judged that the net impact of the proposed action on furbearers (including continued localized human activity associated with mining) would reduce opportunities for observation and trapping of furbearers within the project area by about 50% for the life of the project.

Small Mammals

Small mammal populations, because of relatively low mobility and small home ranges, would suffer direct losses from habitat destruction. These losses might amount to as much as 7,000 animals, mostly deer mice and thirteen-lined ground squirrels per square mile of habitat disturbed (Natural Gas Pipeline Company of America 1976). However, despite the large number of individual animals lost, county-wide population levels would not be significantly reduced.

Some species such as deer mice may achieve higher than normal populations during the early successional stages of reclamation (Sindelar et al. 1974). This could lead to crop depredations, but they would be minor and very localized because of the small home ranges of these animals.

Raptors

It is anticipated that raptor populations would be reduced by the loss of woodland habitat in the project area and disruption of small mammal populations. Swainson's hawks and American kestrels would be affected most.

Olendorff and Stoddard (1973) indicate that Swainson's hawk requires trees for nesting; and Bent (1938) indicates that the following raptors depend on trees for nesting: screech owl, great horned owl, long-eared owl, sharp-shinned hawk, Coopers hawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, and American kestrel. According to Olendorff and Stoddard (1973), "the major assumption . . . is that availability of adequate nest sites is a major limiting factor (to raptors) in temperate grasslands and other relatively treeless biomes."

Among protected wildlife species, raptors are particularly vulnerable to shooting. Illegal shooting has been observed in North Dakota (Albert 1976, personal communication), and it is judged that continued mining, since it would increase access and the number of people familiar with the site, would result in the loss of several raptors per year for the life of the project above a lower level of such loss that would occur without mining.

The short-eared owl, burrowing owl, marsh hawk, and turkey vulture are ground nesters (Bent 1938). However, since there is an abundance of grassland habitat in the project area (Table 2-17 in Chapter 2) and adjacent counties, it is judged that the impact on these species would be minimal.

It is likely that overall raptor losses would measurably reduce opportunities for raptor observation on the project area for the life of the project. A return to original population numbers would depend upon the success of reclamation.

Other Non-Game Birds

Reductions of non-game bird populations would depend upon the amount of habitat destroyed, the success of reclamation, and the resulting food base. It is likely that most bird populations on the project area, particularly those associated with woodlands (Figure 3-3), would be reduced measurably. Some species, such as the English sparrow, which are tolerant of human activities would probably increase slightly. These changes would last for the life of the project and then gradually decrease, depending upon the success of reclamation.

Figure 3-3

Black-headed Grosbeak. It is likely that most bird populations on the project area, particularly those associated with woodlands, would be reduced measurably.

SOURCE: North Dakota Game and Fish Department

Reptiles and Amphibians

Reductions in reptile and amphibian populations are difficult to quantify but would result from direct mortality and habitat loss due to surface disturbance, loss of food species (invertebrates and small rodents), and adverse changes in the water table reducing or removing breeding habitat. Short-term losses (up to 5 years after mining) would be virtually total on mined areas because of the limited mobility of most reptiles and amphibians. Continued human activity would be expected to result in losses from shooting and road kills, especially of snakes.

The reptiles and amphibians that would be lost are not highly valued by the majority of the public because they are seldom seen and are of little or no direct commercial value. They do, however, have important ecological roles; for example, the bull snake helps to control rodent populations.

Reptiles and amphibians would return to disturbed sites following reclamation provided their required habitats (such as wetlands for amphibians) were restored. Most of the original amphibian and reptile populations probably could be restored within 20 years after mining.

Fish

Little change is expected in fish populations in either the Lower Knife or Missouri Rivers as a result of runoff from mining and associated activities.

Runoff from spoils might increase mineralization of river waters. However, significant adverse impacts on lower forms in the food chain of fishes are not anticipated.

Invertebrates

Aquatic invertebrates occurring in the intermittent drainages that drain the project area may be physically destroyed from silt, sediment, or other toxic pollutants which might reach the watercourse. These impacts are not expected to be significant. Terrestrial invertebrates (such as insects) would be physically destroyed in proportion to the loss of vegetative cover in the mining operation. This impact is not expected to be significant beyond the disturbed sites.

Threatened and Endangered Species

Since there is only the most remote chance that any threatened or endangered species (federal or state) would use any portion of the project area, no significant impacts are anticipated.

Short-Term Application Area

Impacts to domestic animals and wildlife on the short-term area would be very similar to those described above for the entire project area. Mining on the short-term area would disturb 715 acres plus an additional 20% for soil storage of rangeland (grassland, shrubland and woodland), reducing available forage in the area by approximately 97 AUMs per year for the life of the project. Since there is a slightly higher concentration of woody draws on the bypass areas compared to the project area as a whole (see Tables 2-17 and 2-20), impacts per acre to wildlife from mining on these areas would be somewhat higher.

There is no evidence to indicate that any federally listed endangered species would be impacted by the mining of the short-term area. Since no habitat for the black-footed ferret (prairie dog towns) occurs on the project area, no impacts on this state listed endangered species in the short-term area would be anticipated.

Since there are no known bald or golden eagle nests or concentration areas and no known falcon cliff nesting sites or active nests within the project area, no impacts on these species would be expected from mining in the short-term area. However, a raptor nest survey should be conducted on the short-term area prior to lease issuance to varify the absence of any potential impact on these species.

No impact on migratory non-game birds is anticipated; however, as indicated in Chapter 2, additional data on the status of these species is necessary prior to leasing.

PREHISTORIC AND HISTORIC FEATURES

Project Area

Prehistoric and historic features are similar in terms of how the proposed action would impact them. These cultural features are composed of man-made objects which are arranged in association with one another and elements of the natural environment. This arrangement is commonly called the context of the objects. An impact to this environmental component is simply defined as anything which would destroy either the context of the objects or the objects themselves; in essence, any action which is ground disturbing at the location of an archeological site. In special cases, objects are not involved in the impacts. A place where an important event took place may be disturbed by altering the setting of the area, although no physical evidence remains. The Glenharold Mine impact zone has been identifed by the project area boundary. However, sites just outside the project area could be impacted similarly to sites in the area by ancillary mining activities.

Prehistoric Features

Primary impacts from construction activities are possible throughout the project area and could occur on sites 32-ME-105, 32-ME-117, 32-OL-207, 32-OL-208 and 32-OL-212. Direct impacts from mining strippable coal will occur to 32-OL-209, 32-OL-210 and 32-OL-213 as these sites overlay coal designated for mining in the proposed Glenharold mine plan of December 31, 1978. Some areas within the project area have not been inventoried. It is impossible to analyze impacts for these uninventoried areas (see overlay No. 1, Map 2-8).

Impacts to the stone circle sites, 32-OL-209, 32-OL-210 and the lithic scatter, 32-OL-213 will result in the total destruction of those sites. None of these sites have been studied thoroughly, and both 32-OL-209 and 32-OL-210 could be important sites in contributing data and answering questions of regional prehistoric significance. Site 32-OL-213 is a two component site with prehistoric and historic features. The prehistoric component of this site may be less significant than the two directly impacted stone circle sites. Destruction of these sites would cause the total loss of the information contained in them.

If sites 32-ME-105, 32-ME-117, 32-OL-207, 32-OL-208 and 32-OL-212 are impacted, their information loss will also be total. Only minimal study has been conducted on these sites. The mound site, 32-ME-105, is on the extreme western periphery of the distribution of mound sites. The stone circle sites, 32-ME-117, 32-OL-207 and 32-OL-208 are located towards the eastern edge of the distribution of such sites, and are poorly understood cultural phenomena of the NW Plains. The lithic scatter site, 32-OL-212, is a large, datable site possibly containing substantial data on Archaic period Plains inhabitants.

Secondary impacts, such as amateur collecting and vandalism by mining crews or the general population, may occur in the project area. Another secondary impact that would occur to the prehistory of this immediate area is a visual one. If further mining occurs in the Missouri Breaks, it will continue destruction of the original context of the prehistoric farming villages found along the terraces above the Missouri River floodplain, including the Knife River Indian Villages National Historic Site. This section of the Missouri River Valley was a scene of extensive cultural activity prehistorically, and the remains of prehistoric farming villages occur in almost every square mile along the river in this area. The way of life in these villages included both farming in the valley and foraging in the surrounding breaks for wild plants and animals to supplement the products of horticultural. Because this valley contains the longest uninundated stretch of the Missouri River in North Dakota, mining activity would visually destroy one of the major places where the natural context could be preserved. Sites that would be visually impacted are listed in Chapter 2.

Historic Features

Direct impacts to historic sites will occur to the homestead sites, 32- OL-211, 32-OL-213 and to the historic coal mines, 32-ME-141, 32-ME-142, 32-ME-143, and possibly the Barlow Mine. Sites 32-ME-141 and 32-ME-143 have already been impacted seriously by mining. Site 32-ME-142 is presently undisturbed as is the Barlow Mine area. Since these coal mines were active in the same coal beds which are being (or are projected to be) mined, they will be completely destroyed. This potential loss or information is of major concern to the State Historical Society of North Dakota, because the loss of such sites diminishes the society's ability to record early coal mining activity in the state. Little study has been done on this phase of North Dakota's technological history.

The homestead sites, 32-OL-211 and 32-OL-213, presently undisturbed, will also be completely destroyed by mining.

Primary impacts from construction activities may result in the destruction of the burial sites, 32-ME-140 and 32-OL-202 and two homestead sites, 32-OL-201 and the Teuber homestead. Historic burial sites while containing extensive demographic data and other information, have an even higher socio-cultural value and destruction or disturbance of such sites may create an irreplaceable heritage and psychological loss to families and residents of an area.

Secondary impacts of relic collecting and vandalism could also endanger the integrity of sites in the project area. A loss of visual context, comparable to that upon prehistoric sites, would occur to historic sites adjacent to the project area. Historic activities centering on the Missouri River Valley include exploration of the West, the fur trade, early settlement and transportation to the gold fields in the mountains further west. Some of the last vestiges of this activity remain within the area visible to the Glenharold Mine. Principal historic sites that would be visually impacted are Fort Clark, three Lewis and Clark campsites, a portion of the Lewis and Clark Trail and the Fort Mandan Vicinity.

National Register of Historic Places

No sites presently listed on the National Register would be directly impacted. One National Register site, the Knife River Indian Villages National Historic Site (Big Hidatsa Village Site), would be visually impacted.

Sites 32-ME-105, in the project area, and 32-ME-106, just west of the project area are apparently eligible for the National Register. According to criteria in Title 36, Code of Federal Regulations, Part 800.10, they would suffer adverse effect. Although both sites are not within the identified area of strippable coal reserves, and so they would not be directly impacted by coal mining, they could be impacted by ancillary activities such as road building or spoil piling, as well as by artifact collecting and visual disturbance.

Sites 32-OL-212, 32-OL-207, 32-OL-208, 32-OL-209 and 32-OL-210 must be evaluated further to determine their eligibility status. Sites 32-OL-209 and 32-OL-210 would be directly impacted by mining, while the other sites may be impacted by ancillary activities.

Short-Term Application Area

The Teuber Coal Mine, 32-ME-142, in T. 144 N., R. 85 W., Section 24 NW1/4NE1/4 overlies identified strippable coal reserves and will be directly impacted by mining. The historic burials, 32-ME-140, in the center of the E1/2SE1/4 of Section 24, T. 144 N., R. 85 W. lie outside of the identified mine line of the Glenharold proposed mine plan, December 31, 1978. However, this site does lie within the zone of primary and secondary impacts. While 32-ME-142 will be completely destroyed by mining, 32-ME-140 may be wholly or partially damaged if it is not avoided. The Teuber Homestead may also be destroyed by mining activities, although it is not yet determined if the federal coal tract which the site overlies will be mined. Additional sites, presently unknown, may exist on the uninventoried tracts. Impacts to cultural features in those areas cannot be analyzed at this time.

AESTHETICS

Project Area

Visual Resource

The visual contrast rating is a method of determining the extent of visual impact for a proposed activity which would modify any landscape feature. This procedure involves measuring the contrast on the four landscape elements (line, form, color, and texture) created by the proposed action against each existing landscape feature, which are land surface, vegetation, and structures. The significance of the impact on visual resources is dependent in part on the visual resource management classes as discussed in Chapter 2. The higher classes are more sensitive to visual contrast; therefore, they will more often have impacts considered severe. For a more complete discussion of the procedure, see Appendix 3, Figure 1.

Two ratings have been made, one during mining and the other after reclamation. Table 3-4 is a summary of the resultant contrast rating as found in Appendix 3, Figure 1.

For the contrast during mining, a high adverse visual impact would occur. This contrast represents a maximum contrast rating within the visual corridor of State Highway 200A. This rating includes only

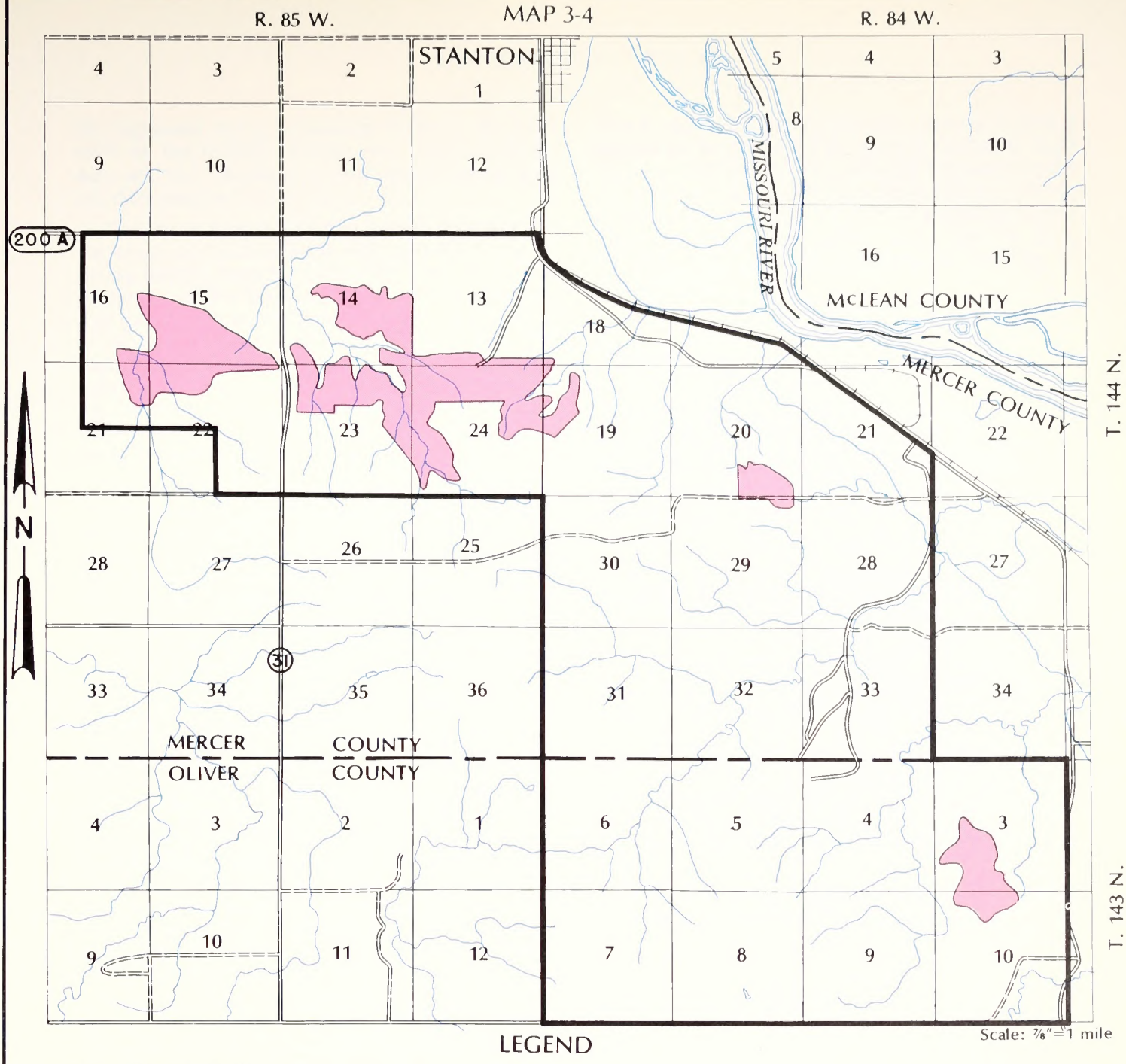
TABLE 3-4

VISUAL IMPACT DURING MINING

Area	Feature	Visual Impact Analysis 1/
Area within the visual corridors of State Highways 200A, 31, and 48 during mining	Land Surface	Severe
Area within the visual corridors of State Highways 200A, 31, and 48 during mining	Vegetation	Severe
Area within the visual corridors of State Highways 200A, 31, and 48 during mining	Structures	Severe
Area within the visual corridors of State Highways 200A, 31, and 48 after reclamation	Land Surface	Insignificant
Area within the visual corridors of State Highways 200A, 31, and 48 after reclamation	Vegetation	Insignificant
Area within the visual corridors of State Highways 200A, 31, and 48 after reclamation	Structures	Insignificant

1/ See Appendix 3, methodology 1, for standards used for this analysis.

SOURCE: Araki 1977.



SOURCE: Araki, 1977

VISUAL IMPACTS

the expanded mining operations. Existing intrusions such as the loading facilities and office buildings, etc., are not discussed in this section since they are discussed in Chapter 2.

The visual impact would be severe particularly in the visual corridors of State Highways 200A and 31 during mining. Map 3-4 shows the area of the approximate severe visual disturbances. It is expected that three years would elapse between the initiation of mining and visually acceptable reclamation. The importance of the visual corridor of State Highway 200A is that it is a major route with many sightseeing travelers. It also coincides with the Missouri River valley area, which is one of the more scenic areas of North Dakota.

Some of the temporary intrusions introduced by mining would be spoil piles, stockpiles of topsoil, and high walls, which are a severe impact on the landforms. Clearing vegetation for mining and haul roads would be a severe visual impact on vegetation because of contrast between the soil or rock and the native grassland or woody draw vegetation on the landscape. Additional roads and draglines on the skyline would cause a high contrast.

Map 3-4 shows moderate, cumulative visual impacts for areas outside the visual corridors of State Highways 200A and 31. Particular adverse visual impacts of mining would be from spoil pile ridges on the skyline of the plateau and the dragline towering above the skyline. The severe impact is currently visible from State Highway 200A. Outside the visual corridors, movement of the dragline when near plateau tops or at existing topographic levels would attract the eye; however, this may be temporary as the dragline moves further from the plateau tops away from visual corridors or to lower elevations or levels of operation.

The visual impact would be insignificant after successful reclamation. However, flatter hills and moderate slopes would remain as evidence of land disturbance.

Sound

The existing sound environment within the project area would remain essentially the same. No new sound sources would occur as a result of the proposed action; however, the location of the source for various noises would move to different areas as mining progresses. As mining activity would move closer to some homes, residents would experience increased noise levels. Mining in Sections 13, 14, 23 and 24 of T. 144 N., R. 85 W., would move the sources of noise closer to State Highways 31 and 200A. One residence along Highway 31 would be directly affected. Noises of mining operations as perceived by Stanton residents could increase slightly. Noises could also increase slightly for motorists along Highways 200A and 31. Mining in the southern part of the project would be further from Stanton and Highways 200A and 31 and, therefore, mining noises would not be heard by as many people.

Odors

Continued mining would not increase the amount of odorous emissions. Due to factors of dispersion and the essentially non-polluted environment, the odor levels should not measurably change.

Short-Term Application Area

The visual impacts would be severe in the short-term application area within the visual corridors, such as Highways 200A, 31 and 48.

Increased sound levels due to mining would be the same as those previously discussed; however, because sound level increases would generally be removed from noise sensitive areas, such as Stanton, such increases would be perceived by fewer people.

Mining within the short-term area would produce essentially insignificant impacts from odors.

RECREATION

Project Area

Outdoor Recreation Areas

Recreation experiences at the Knife River Indian Villages National Historic Site (one and three quarters miles north of the project area) would continue to be degraded by sounds and sights of mining. The ability to appreciate historic resources is based, in part, on the surroundings being similar to those at the time of historical importance. The historical integrity of the area has already been modified by generating stations, power lines, cleared river bottomlands for agriculture, and residential de-

velopments. Continued mining would be a slight additional visual intrusion on the landscape and would impair somewhat visitor appreciation of historic features. Visitation at the Knife River Indian Villages site is expected to be substantial after 1981, and the magnitude of impacts from continued mining would increase as visitation increases. Successful reclamation and the movement of mining activity to locations further from Stanton would significantly reduce the significance of these effects. Impacts from the proposed action would be similar at the Fort Clark State Historic Site. The same loss of historical integrity and quality of recreation experience would occur to the Lewis and Clark National Historic Trail. The Lewis and Clark Highway Trail would be similarly affected. Because tourism, now and in the future, would likely depend on the historical resources of the Missouri River and breaks, loss of historical integrity due to the Glenharold Mine could cause a slight decrease in the quality of future tourism. In reclamation is successful and the original contour of the land is generally restored, the long-term impact would likely not be significant.

Outdoor Recreation Activities

Hunting opportunities, in terms of success rate, would be reduced if mining were to contine. By 1998, big game and upland game numbers would be reduced by half. Predators would temporarily be displaced in the areas being mined. The length of time this impact would be felt would depend on the timing and ultimate success of reclamation. Assuming a return to pre-mining habitat within 30 years, hunting opportunities would also return within that timeframe (see Vegetation section).

Water-based recreation activities such as canoeing, powerboating, waterskiing, and fishing would continue to take place within viewing and hearing distance of mining activity. This effect on recreationists is not expected to be significant because of the existing modified environment which includes the Leland Olds and United Power Association-Cooperative Power Association power plants.

Short-Term Application Area

No designated recreation sites or potential state nature preserves would be directly disturbed by mining. The impairment of recreation experiences and the reduction in hunting opportunities would occur to nearly the same degree even if no mining was allowed in the short-term application area. Due to the fragmented pattern of mineral ownership, the possibility exists that, without federal coal, a larger area would be disturbed by mining in order to meet the Glenharold Mine's coal commitment.

No unique recreation values would be lost or signficantly impaired by the leasing and subsequent mining of the short-term application area.

ECONOMIC AND SOCIAL CONDITIONS

Project Area

Employment

The Glenharold Mine facility employs 156 direct workers. Assuming 1.7 indirect workers for each direct worker, it is estimated that there are approximately 265 indirect workers associated with the continued operation of the Glenharold Mine facility. Consequently, the total number of workers who would be either directly or indirectly associated with the continued operation of the mine is estimated at 421. This figure represents approximately 14% of the estimated annual employment in the two county (Mercer and Oliver) area between 1975 and 1985. This percentage was calculated using an estimate of 3,100 as the average annual employment level in the two county area between 1975 and 1985 (employment forecasts are from the North Dakota Regional Environmental Assessment Program).

Population

Operation of the Glenharold Mine facility through the year 1998 would result in continued population impact in the two county area. Based upon assumptions concerning average family size of direct and indirect workers associated with the Glenharold Mine, approximately 1,380 people would continue to reside in the two county area as a result of continued mining. This figure represents approximately 16% of the total estimated population in the two county area by 1998. This percentage was calculated using a population estimate developed by the North Dakota Regional Environmental Assessment Program (1977).

Income

Glenharold Mine payroll and company expenditures were approximately $2,948,000 and $374,974, respectively, in 1976. Using gross receipts multipliers for the household sector (3.08) and retail trade sector (2.09), it is possible to estimate the total dollar value of gross business volume in North Dakota attributable to continued operation of the Glenharold Mine. (See Appendix 3, Figure 2 for methodology of gross business volume estimation.) Using this method, it is estimated that continued operation of the Glenharold Mine contributes approximately $9.9 million annually in gross business volume to the state. This figure assumes that the entire annual Glenharold Mine payroll is spent within North Dakota. Any inflation over time will increase this figure accordingly.

Public Finance

The mining of 3.7 million tons per year at the Glenharold Mine through the year 1998 would continue to generate substantial severance tax revenues if the current tax law is extended past its expiration date of June 30, 1979. The average annual tax rate for 1979 is estimated to be $0.85 per ton. Since future tax rates after June 30, 1979, under a new tax law can only be speculated, Table 3-5 shows the estimated total severance tax collections and gross revenue distribution from Glenharold Mine production assuming a 7% annual growth in the tax rate past 1979. It should be noted, however, that as the tax rate inflates, the value of the dollar from year to year also diminishes by 7% under this assumption. Thus, just as $100 in 1977 would be worth only about $20 in the year 1998, the inflated annual severance tax collection would remain at about the same relative value in the future.

Distribution of the local tax share among the county, cities, and schools of the county of production would supplement their annual operating budgets. Considering that the present coal production at Glenharold Mine within Mercer County would shift entirely to Oliver County by 1987 (as mining progresses to the southeast across the county line), these local revenues would then also shift to Oliver County. This would have an adverse effect on Mercer County since it would be deprived of revenues it would be accustomed to and which would have to be derived from another source. Conversely, it would have a beneficial effect on Oliver County, which has much lower total revenue needs than Mercer County.

The state and federal governments would derive equal shares of the federal royalties collected on any production of federally owned coal at the Glenharold Mine. There is an estimated 23.2 million tons of federal recoverable coal contained within the estimated 72.2 million tons of recoverable coal in the Glenharold Mine project area. Therefore, utilizing a 1977 selling price for coal produced at Glenharold Mine of $4.40 per ton (Duryea, personal communication 1977), total royalties would amount to over $20 million in 1977 constant year dollars. Of this amount, the state and federal governments would each derive a total of over $10 million. these royalties would be collected twice annually as the coal was mined, and would reflect the current selling price of the coal.

Increases in annual property tax assessments on taxable property within the Glenharold Mine project area during the next few years of operation would be relatively insignificant. This is because little new taxable property is expected to be developed and assessments of taxable value in Mercer County have not risen in proportion to the inflationary growth of real property value. Thus, continued operation of the Glenharold Mine would not produce any substantially increased property tax revenues to local units of government relative to the present amounts.

Agriculture

Operation of the Glenharold Mine would disturb about 211 acres per year during the years of proposed mining. Most of the land that would be disturbed is valuable for agricultural use. The land would not be usable, and hence would yield no income from crops or livestock for a period of up to 5 years.

After reclamation, the mined land theoretically would be as productive as it had been before mining. Some parcels of land would be capable of being used in new types of farming or ranching operations that could produce higher dollar returns than the pre-mining practices.

If reclamation were to fail to return the mined land to its pre-mining productivity, dollar returns would be reduced. The loss could be insignificant in relation to the total agricultural production in Mercer County, but it would be vital or disastrous to the individual whose livelihood depends on the mined acreage.

TABLE 3-5

PROJECTED STATE COAL SEVERANCE TAX COLLECTIONS AND DISTRIBUTION FROM COAL PRODUCED AT THE GLENHAROLD MINE

YEAR	COLLECTION		DISTRIBUTION 3/			
	Tax Rate 1/	Total Tax 2/	State 30%	Trust Fund 15%	Coal Impact Office - 35%	Local Share 20%
1979	$0.85	3,145,000	943,500	471,750	1,100,750	629,000
1980	0.87	3,219,000	965,700	482,850	1,126,650	643,800
1981	0.89	3,293,000	987,790	493,950	1,152,550	658,600
1982	0.91	3,367,000	1,010,100	505,050	1,178,450	673,400
1983	0.93	3,441,000	1,032,300	516,150	1,204,350	688,200
1984	0.95	3,515,000	1,054,500	527,250	1,230,250	703,000
1985	0.97	3,589,000	1,076,700	538,350	1,256,150	717,800
1990	1.07	3,959,000	1,187,700	593,850	1,385,650	791,800
1995	1.17	4,329,000	1,298,700	649,350	1,515,150	865,800
2000	1.27	4,699,000	1,409,700	704,850	1,644,650	939,800

1/ Uses a value of $0.85/ton in 1979. A 7% annual increase in the wholesale price index (wpi) is assumed thereafter, translating to a 1.75¢/year increase in the tax rate based upon a 1¢ increase/4% increase in the wpi.

2/ Assumes constant production of 3.7 million tons per year.

3/ Assumes same distribution after June 30, 1979, as under present law.

SOURCE: Cabe 1979.

TABLE 3-6

PROJECTED STATE COAL SEVERANCE TAX COLLECTIONS AND DISTRIBUTION FROM THE GLENHAROLD MINE SHORT-TERM APPLICATION AREA

YEAR	COLLECTION		DISTRIBUTION 3/			
	Tax Rate 1/	Total Tax 2/	State 30%	Trust Fund 15%	Coal Impact Office - 35%	Local Share 20%
1981	$0.89	3,293,000	987,900	493,950	1,152,550	658,600
1982	0.91	3,367,000	1,010,100	505,050	1,178,450	673,400
1983	0.93	3,441,000	1,032,300	516,150	1,204,350	688,200
1984	0.95	3,515,000	1,054,500	527,250	1,230,250	703,000
1985	0.97	3,589,000	1,076,700	538,350	1,256,150	717,800

1/ Assumes 7% annual growth in wholesale price index beyond a base rate in 1979 of 85¢/ton.

2/ Assumes 3.7 million tons per year.

3/ Assumes same distribution after June 30, 1979, as under present law.

SOURCE: Cabe 1979.

Health

Direct and indirect employees of the Glenharold Mine and their dependents would continue to generate approximately 15 to 20% of the local demand for medical services with the continued operation of the Glenharold Mine through the year 1998. This demand places a strain on health personnel because of the shortage which exists in the Mercer-Oliver County area, particularly for physicians. The area hospital has sufficient capacity to meet this demand.

Statistically, mining at the Glenharold Mine would result in continued opportunity for injuries. Based on 1976 mine safety data from the Mine Enforcement and Safety Administration, and on the projected employment, about two mine-related fatalities and 119 non-fatal mine injuries would occur during the approximate 20 years of continued mining.

Concern has been expressed by citizens of North Dakota that spoil piles associated with future strip mining may increase the incidence of tapeworms potentially harmful to man. The tapeworm *Echinococcus multilocularis* has been noted to occur in deer mice in slightly higher percentages in strip mined piles in Ward and McLean Counties (Leiby and Kritsky 1974). Final hosts in this parasite's lifecycle are dogs, foxes, coyotes, and cats. Intermediate hosts include sheep, cattle, pigs, horses, deer mice, and man. Adult tapeworms in dogs, for example, pass eggs which are deposited in the animal's feces. Domestic livestock, mice, and man ingest the eggs through drinking water, contaminated grass, or handling of a dog, coyote, fox, or cat. Hydatid cysts form in the intermediate host. In extreme cases, these cysts can be fatal, even in man. The lifecycle of the tapeworm is completed when a fox or coyote eats an infected mouse or dead domestic animal.

Spoil piles create good habitat for deer mice which are eaten by foxes and coyotes. In sufficient quantities, these hosts can keep the tapeworm "active." However, no cases of hydatid disease were reported in humans in North Dakota in 1976 (Flagg 1976, personal communication), and no increase is anticipated from strip mining in the Glenharold project area.

Housing

With continued operation of the Glenharold Mine through the 1998, direct and indirect employees of the Glenharold Mine would continue to occupy 316 housing units, which currently represents 10.5% of the housing units in the Mercer-Oliver County area. Housing conditions within the Mercer-Oliver County area should be adequate to meet this demand.

None of the tenants of the housing units within the Glenharold Mine project area would be affected by the proposed mining plan.

Education

With continued operation of the Glenharold Mine through 1998, approximately 331 students in the Mercer-Oliver County area would be estimated to be dependents of direct and indirect workers associated with the Glenharold Mine. This number would continue to represent approximately 16.6% of the total Mercer-Oliver County area student enrollment. Mercer-Oliver County schools have sufficient capacity to accommodate this number of students.

Short-Term Application Area

The mining of 17.8 million tons of federal coal contained within the short-term application area would create significant revenues for the state of North Dakota. Mine production is about 3.7 million tons per year.

Table 3-6 shows the annual projected coal severance tax collections and distributions from the mining of the short-term application area during the five year period 1981-1985.

It is likely that no additional annual employment population or income would result from the eventual mining of the short-term application area. It is, however, likely that overall mining activity would continue at the Glenharold Mine for five to six years longer if the short-term application area was mined. The continued impacts discussed earlier in this section attributable to the continued mining rate of 3.7 million tons per year would be virtually identical to those expected from mining of the short-term application area at an average rate of 3.7 million tons per year.

LAND USE

Project Area

Table 2-26 in Chapter 2 classifies by use the land which would be disturbed under the proposed mining area. About 83% of the land (2,923 acres) is either cropland or rangeland. Most of the balance is forest land/wooded. The proposed mining area includes 193 acres of prime farmland. Assuming the proposed mining area is suitable for reclamation and prior productivity can be restored, impacts on agricultural land and rangeland use categories would be largely temporary in nature.

Approximately 211 acres would be disturbed each year, impeding normal crop and livestock production on this land. The 1974 Census of Agriculture's Preliminary Report for Mercer County placed the value of crops sold in 1974, including hay, at approximately $24.39 per cropland acre and the value of livestock products sold at $24.32 per acre of rangeland. Assuming each of the 2,923 acres of cropland and rangeland is disturbed no more than five years, agricultural production loss would total about $380,000. In the event subsidence, erosion problems, soil composition changes, or modified water tables leave the land unable to support renewed cropping or grazing, mined areas would revert to less intensive uses, such as wildlife production, with diminished economic return to the landowner. Should this occur, the 2,932 acres of disturbed agricultural land would be fully or partially removed from production for an indeterminate period of time.

While reclamation might be viewed as a success in terms of comparable yields before and after mining, the cost of water, fertilizer, or other inputs to the land needed to produce those yields may not be comparable and could be higher.

Forest land and wooded acreage comprises 17% of the proposed mining area. Traditional reclamation efforts attempt to circumvent time and natural succession in re-establishing plant communities and, in North Dakota, emphasize agriculture; i.e., restoration of crop and grazing land. The complex shrub and tree ecosystems found in the wooded draws would be difficult to duplicate and are irreplaceable in the short term (15 years or less) (Bureau of Land Management, Glenharold Environmental Assessment Record 1976).

Some rangeland or forest land could be permanently replaced by more intensive uses. Landowners are entitled to designate post-mining land use plans in accordance with North Dakota Century Code Chapter 38-14 and the Surface Mining Control and Reclamation Act and may prefer that property, previously limited to rangeland or forest land use due to topography or drainage, be restored in a manner allowing cropland use following mining. This replacement could result in a loss of wildlife habitat, increased soil erosion, and additional water sedimentation.

Since there would be no expansion of permanent mine facilities beyond those now existing, the amount of land classified as urban/built-up would remain the same.

Despite its temporary nature, mining would continue to have a negative impact on land uses not compatible with it, particularly with regard to project area surface owners. Impacts could include removal of or damage to gates, fences, cattleguards, and trails and reduction of ephemeral stream flow and ground water quality. Blasting, machinery noise, and fugitive dust generated by mining operations would also adversely affect residents in proximity to the mining activity. Establishment of noxious weed species on disturbed sites could also occur. It is unlikely that reclaimed lands would be immediately suitable for home or building construction due to subsidence and soil instability.

Transportation

Since mining operations with the proposed action will bring no increase in employment at the mine, no changes in traffic generation are anticipated. Beyond the new bridge and continued maintenance, no other improvements to the highway system would be necessary.

Ownership

The mining of 3,547 acres within the proposed mining areas would impact 15 private landowners and one homestead over private coal.

Planning and Zoning

The proposed action would be consistent with existing Mercer County zoning which allows mining of land classified as agricultural with a conditional use permit. Since the proposed mining area includes areas outside those authorized under the existing conditional use permit granted by the Mercer County Board of Commissioners, an amendment would be required adding approximate-

ly 1,705 acres. It would be necessary to secure this permit before mining begins in Section 14, T. 144 N., R. 85 W., outside existing permit limits.

Consolidation Coal Company would also need to obtain a conditional use permit, authorizing mining of the 1,453 mining plan acres in Oliver County, from the Oliver County Board of Commissioners.

Short Term Application Area

Impacts as discussed in the above section would also occur to varying degrees on the short-term application area. Specifically, 319 acres of croplands would be impacted at a loss of about $40,000 from cropland production. Loss of 859 acres of rangeland would result in a loss of about $150,000. Therefore, the total loss in agricultural products would amount to about $190,000.

Chapter IV
Mitigating Measures

PROJECT AREA

This chapter includes mitigating measures designed to lessen the potential impacts of the proposed action upon the existing environment and to provide for mitigation of impacts as required by the Surface Mining Control and Reclamation Act, the North Dakota Century Code, and other applicable federal, state, and local regulations. These measures provide the basis for the analysis of unavoidable impacts in Chapter 5. All of the mitigating measures selected by the regulatory authority will apply to federal coal reserve areas and may apply to such coal reserves under other ownership as designated by the regulatory authority.

Mitigating Measures

Stipulations 4, 8, 11, 15, 16, and 17 may exceed minimum requirements of federal and state regulations. Stipulations 1, 2, 5, 6, 7, 9, 10, 13, and 14 are more explicit than wording in the Surface Coal Mining and Reclamation Operations permanent regulatory program.

1. To comply with 30 CFR 800 regulations for cultural resources, leases shall contain stipulations requiring applicants to perform the following measures. The applicant shall contract a qualified archaeologist to perform i and ii below. A qualified professional paleontologist shall be contracted to perform vi. The federal agency involved in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation shall undertake iii and iv. These stipulations apply where federal permitting, licensing, or authorization is required, regardless of surface and mineral ownership. The stipulations are:

   i. Inventory of records and land surface by applicant shall be made to identify prehistoric features on all uninventoried tracts in the impact zone. (See Map 2-8 for impact zone boundaries).

   ii. Reports shall be submitted to the regulatory authority detailing prehistoric and historic features and identifying any properties which would be potentially eligible for the National Register of Historic Places.

   iii. Eligibility of sites for the National Register shall be determined in consultation with the State Historic Preservation Officer. Effect or impact on National Register-eligible sites must also be determined in consultation with the State Historic Preservation Officer. The Advisory Council on Historic Preservation must be given opportunity to comment on effect or impact determinations.

   iv. If it is determined that there will be an effect on National Register-eligible sites, comments by the Advisory Council regarding determinations of methods of data collection, avoidance, preservation, mitigation of adverse effect, or other methods of cultural resource treatment must be considered by the regulatory authority before these sites are affected by lease action.

   v. Work shall be halted if cultural remains are found during mining or construction until those remains are evaluated; and, if significant, a reasonable time would be allowed for salvage of those remains.

   vi. An inventory of the lease area where mining would likely occur shall be made for significant paleontologic resources prior to approval of the mining plan. If such resources are found, the mining plan will be modified to protect such resources or a salvage plan will be devised and made a part of the mining/reclamation plan.

2. There shall be neither partial nor total destruction of woodland ecosystems within this lease area either through directly mining underlying coal or through mining activities associated with the removal of adjacent coal unless all of the following can be accomplished:

   A. The lessee satisfactorily demonstrates to the North Dakota Public Service Commission, Office of Surface Mining, Bureau of Land Management, and Geological Survey within the Operations and Reclamation Plan as required by Section 6 of the Mineral Leasing Act of 1920, as amended that:

      i. it is necessary to destroy the woodland ecosystem in order to meet development, production, resource recovery and protection, diligence, and maximum economic recovery requirements; and

      ii. an equivalent woodland ecosystem can and will be restored as the post-mining land use for those sites that will be destroyed.

B. Written agreement and approval to the demonstrated necessity and restoration plan be acquired from each of the agencies named in the above (1) paragraph. Implementing this measure would reduce the estimated annual wildlife losses shown in Table 3-3 by about 50%.

3. If critical areas needed or used by threatened or endangered species are identified on the project area as a result of future studies or observations, the operator shall be required to avoid disturbance of such sites. This is enforceable under the Endangered Species Act of 1973 and would make impacts on federally listed species even less likely.

4. Flowing springs and other wildlife water sources which are eliminated by the mining operation shall be replaced with deep wells or other alternative water developments approved by the state mining supervisor which would create aquatic or wetland habitats similar to those that existed prior to mining. This would avoid the loss of important watering sites for wildlife. In those cases where this is not enforceable under NDCC 38-14-05 and 38-14-13 and P.L. 95-87, it would be enforceable under 30 CFR 30, part 816.111 since it would not be possible to achieve the same seasonal diversity of vegetation without restoring the water.

5. To reduce destruction of soil aggregation, and to obtain more uniform compaction, mechanical manipulation shall occur when soil and overburden are dry or frozen.

6. To reduce subsidence and piping hazards, mechanical methods of even compaction will be utilized in respreading of overburden. Respreading of topsoil of widely different physical properties than underlying spoils should be avoided to minimize horizontal water movement at the topsoil-overburden interface. The surface of respread spoils in situations of high compaction potential shall be chiseled or ripped to minimize interface problems.

7. Significant quantities of suitable plant growth material within the upper levels of the overburden, such as occur in section 15 and possibly adjacent sections, shall be saved to supplement soil in respreading over contoured overburden.

8. All topsoil storage piles retained three months or longer during the growing season shall be seeded with appropriate vegetation at rates specified and designated in the approved mining and reclamation plan.

9. All seedbed preparations, beginning with topsoil replacement, seeding, planting, and all conservation practices initiated shall be done on the contour.

10. Contour terraces, furrows, or other soil and water conservation structures shall be constructed on all slopes recommended by, and to the specifications and design of, the appropriate agency.

11. Native hay or straw used as mulch or for snow catchment must be certified by the North Dakota State University Experiment Station as noxious weed free.

12. All mulching materials must be anchored to the ground surface with techniques specified in the approved mining and reclamation plan.

13. When soil and moisture conditions are favorable, all seeding and planting shall be done after September 1 and before May 15.

14. All shrub or tree plugs shall be planted in early spring (prior to May 15) as soon as soil moisture and soil temperature conditions will permit.

15. All shrub and tree plantings shall be watered while the plant or plug is being planted. Adequate water shall be applied to saturate the planted root zone to avoid root dehydration and insure soil-root contact. A water soluble fertilizer-root stimulant shall be added to the water to the manufacturer's recommended rate to the water used for shrub or tree planting or plugs. Additional watering shall be done over the next three growing seasons when soil moisture conditions indicate the need for plant survival.

16. All reclaimed areas shall be temporarily fenced to exclude livestock, deer, and antelope where specified in the approved mining and reclamation plan.

17. In order to minimize the visual impact caused by surface mining, especially near the major roadways, assistance by a qualified landscape architect shall be contracted. Consideration shall be given to the views from the Knife River Indian Village, Historic Fort Clark, and tourists following the Lewis and Clark Highway Trail.

Other Desirable Measures

Measures which are not enforceable--exceeding requirements of existing federal and state regulations--but which would further minimize impacts and enhance the success of reclamation are recommended for consideration by the regulatory authority and the operator. These measures include:

1. Secondary impacts, resulting from amateur artifact collecting, could be mitigated by surveillance, fencing, burial of known sites by overburden or topsoil, education of employees and the public con-

cerning the fragile nature of archaeological sites and the deleterious effects of artifact collecting, and non-disclosure of site locations. A lease stipulation requiring the applicant to take all reasonable and necessary measures to preserve cultural resources could result in the use of the above measures.

2. Any significant amounts of sand, gravel, or clinker that may be encountered during the mining operation could be saved and stockpiled for use in construction during the life of the operation. The company should attempt to locate market for leonardite (oxidized coal) that would otherwise be mixed with the spoil and lost to future use.

3. On selected areas, plugs of shrubs and trees could be transplanted in lieu of potted shrubs or trees. Plugs would be a minimum of 5 feet in diameter and a minimum depth of 3 feet. Plugs would be moved by tree spade machine or other approved method from areas to be stripped of topsoil. All plugging would be done during the months of February through May; other times and methods of plugging may be done with prior written approval of the regulatory authority.

4. Native prairie grasslands could be transplanted using scrapers or other approved machinery by removing the surface four inches of areas to be stripped of topsoil and placing vegetative debris including natural seed and rizomes immediately on a properly prepared seedbed. All transplanted material should be a minimum of two inches thick and all areas would be immediately rolled with a sheep foot earth packer and saturated with water to insure soil-root and soil-seed contact. Minimum rate of watering will be equivalent to .25 inch of rainfall, or 6,788 gallons per acre.

5. All seed could be drilled to aid in seed distribution and germination.

6. All seed could be treated with a repellant to prevent seed damage by rodents and birds.

7. Snow fence panels (5 to 6 feet in length and 3 feet high) or bales of hay set on the cut edge could be placed perpendicular to the prevailing wind at random intervals over reclaimed areas, the spacing determined by the regulatory authority, and dependent upon slope and linear distance of exposure to prevailing winds.

8. The boundary of the mined area could be "varied" or feathered during reclamation. This would reduce the strong contrast between mined and unmined areas and partially mitigate the impact on aesthetic values.

9. Access and construction roads could be located in a manner that would preserve the natural landscape character, particularly in the visual zones of high sensitivity. Road alignment should follow natural contours, and vegetative clearing and surface disturbance should be minimized. Mining activity should be screened from view where possible by use of existing topography.

10. Draglines and other mining equipment colored in earth tones (browns, golds, and greens) and harmonizing tints could be used to minimize visual contrast.

11. Trucks, tractors, scrapers, shovels, draglines, and drills could have more effective mufflers or noise attenuation devices added. A company sponsored noise monitoring program throughout the project area could be initiated to identify noise levels in excess of published standards.

12. Amending the North Dakota Reclamation Law to require either the mining company or the regulatory authority to assume the liability for annually compensating landowners for any long-term loss of productivity capability on reclaimed lands would serve to mitigate the corresponding economic loss.

SHORT-TERM APPLICATION AREA

As the short-term application area contains coal reserves totally under federal ownership, all of the recommended mitigation measures selected by the regulatory authority for the Glenharold project area would apply.

These stipulations would include cultural resource and paleontological inventories of the 280 acres of federal coal previously unsurveyed prior to approval of a mining plan; identification of potentially eligible National Register of Historic Places sites; determination of eligibility in consultation with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation; determination of impact effect; and mitigation of National Register and non-National Register sites that would be adversely impacted. Secondary impacts are also mitigated completely or partially by lease stipulations previously discussed.

At present, no known National Register listed or eligible sites are known on the federal coal tracts applied for by Consol to lease. Two sites, the Teuber Homestead and 32-ME-142 (Map 2-8), would be mitigated by the recommended lease stipulations. The historic burials, 32-ME-140 (Map 2-8), would be preserved by avoidance.

Chapter V

Adverse Impacts Which Cannot Be Avoided

PROJECT AREA

Continued mining of the Glenharold Mine would disturb an additional 3,547 surface acres underlain by inplace reserves of 84.9 million tons of coal. About 85% or 72.2 million tons of coal would be recovered during mining. Surface disturbance would average 211 acres annually. Between 775 to 1,055 surface acres would be out of production during any given year.

Soil would be translocated or lost to the project area through water and wind erosion. Annual water erosion losses of topsoil during the period between excavation and vegetation establishment would be considerably less than the 118 tons per acre estimated in a worst case situation in areas of very high erodibility hazard on terrain with slopes that exceed 15%. North Dakota statutes provide for creation of the most gentle post-mining topography consistent with the surrounding terrain. With the resulting gentle slopes, long-term erosion losses could be reduced by more than 50% on lands whose present slopes exceed 9% (66% of the coal reserve area).

Of the strippable coal reserve area, 23% contains soil material with a severe risk of wind erosion. In a worst case situation, some 51 tons of topsoil per acre could be lost within a year from clayey materials with 1,000 feet of linear exposure to wind. Actual losses would be much lower.

Subsidence and cave-ins would occur from water piping through the replaced overburden. The extent of these impacts has yet to be quantified.

Short-term (approximately 20 years) use of the area for coal mining would result in an estimated maximum loss of 20,000 bushels of wheat, and 19,175 animal unit months of livestock forage.

Principal air quality degradation is expected to be from particulates. The operation of the Glenharold Mine would account for 7% and 3% of the respective particulate totals for Mercer and Oliver Counties. Off-site concentrations of particulates are not expected to be appreciably increased.

Several changes would occur in the local hydrologic regime, but these changes would not result in severe impacts. Drainage divides and patterns in the Missouri and Knife River watersheds would be slightly altered, resulting in very minor changes in runoff and infiltration. Prior to complete rehabilitation any surface runoff from the mine would carry greater volumes of sediment than normal. The lignite which is presently an unused aquifer would be replaced by overburden material with greater water transmitting properties. Some of the present ground water seepage into drainages would dry up.

Within the project area, layering, compactness, and cohesion of 3,547 acres of bedrock ranging in thickness from 1 to more than 110 feet would be obliterated. Any fossil material that is not detected and preserved would be destroyed or lost in the spoil.

Most wildlife populations on the project area would be reduced 20 to 25% for the duration of the project. These impacts would result primarily from the disruption of native vegetation communities, and their duration beyond the life of the project would depend upon the success of reclamation. Note, however, that these reductions are 50-60% less than those shown in Table 3-3 due to implementation of the mitigation recommended in Chapter 4. Impacts on waterfowl would not be significant regionally, but might amount to the loss of 15 birds to flight stage annually. Small mammals and other animals with small home ranges would suffer direct losses from habitat destruction on the mined areas. However, despite the large number of individual animals lost, countywide population levels would not be significantly reduced.

Wildlife appreciation and hunting opportunity losses resulting from mining would not be fully mitigated. To the degree that animal populations decreased, hunting opportunities would also decrease.

There would be a slight increase in adverse visual disturbances caused by continued mining through 1998 and the additional time necessary to complete reclamation. Sound levels remain at about the same as a result of continued mining activity and coal transport machinery.

The general topography would be reduced to a gentler (more rolling and undulating) form than presently exists.

During the remaining life of the project, the decrease in the quality of experiences associated with tourism, historic appreciation, driving for pleasure, and recreational use of the Missouri River corridor would not be fully mitigated.

Destruction of cultural resources would occur where these resources were present in the mining area but not recognized prior to mining. Significant losses in scientific knowledge could occur if unique

sites were in fact present but not recognized prior to destruction.

The 15 to 20% increased demand on local health personnel, especially physicians, generated by direct and indirect employees of the Glenharold Mine and their dependents would continue to be a residual adverse impact. The two mine related fatalities and 119 non-fatal mine injuries expected to occur as a result of continued mining at the Glenharold Mine (based on national statistics) would be a residual adverse impact.

SHORT-TERM APPLICATION AREA

The residual impacts associated with the short-term lease areas are similar to those for the entire project area. In general, the areal and temporal extent of the impact is increased but not the severity of the impact.

Mining and recovering 17.8 million tons of coal within the short-term application area would disturb 983 total acres. Soil would be lost through wind and water erosion, especially with the highly susceptible areas within sections 14, 22, 24, and 30. Water erosion losses would be considerably less than worst case situation estimates of 118 tons per acre. Maximum wind erosion losses of 51 tons per acre also are not expected.

Subsidence and piping would occur to an unknown extent.

An estimated maximum loss of 1,436 bushels of wheat and 2,300 animal unit months of livestock forage would occur during mining. The long-term productivity would be maintained through rehabilitation and development of new management techniques.

Air quality impacts would be extended for an additional five years until mining was completed. The emissions rate, however, would remain the same for any given year.

Impacts to the hydrologic regime and wildlife would be similar to those of the project area.

The probability of destroying undiscovered cultural resources would be extended to the short-term lease area.

Recreational and visual impacts would be extended for about five years until mining was completed.

Chapter VI

The Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

PROJECT AREA

The present dominate use of the area is for coal mining. Eventually, the Glenharold Mine would disturb 5,525 acres of strippable coal reserves, totaling about 98.6 million tons, if all the coal within the project area were mined. Upon reclamation, the area could return to its original land uses including livestock grazing, wildlife habitat, and farming.

An average of 211 acres within the proposed mine area would be disturbed annually. An equivalent amount of land would be brought back into productivity annually once the mining operation progressed through reclamation, estimated to take three to five years. When fully operational, the mining operation would result in about 775 to 1,055 acres being in various stages of disturbance and reclamation annually for the life of the project.

Short-term use of the environment for coal production would result in a loss of an estimated maximum of 20,000 bushels of wheat and 19,175 animal unit months of livestock forage for the proposed mining areas. Long-term productivity of these mined and disturbed lands is highly dependent upon levels of management and management techniques employed after reclaimed lands are released back to surface landowners. Reclaimed lands would require a higher or at least a different level of management in order to maintain its reclaimed productivity over 20 to 50 years or longer (Lorenz 1977). However, most vegetative research specialists agree that long-term productivity can be maintained and will be maintained through the development of management techniques and educational programs for surface landowners.

Mining would cause minor temporary interruptions of streamflow in segments of the intermittent streams that drain the area. With restoration of the land surface, drainages would be reestablished with one probable modification. Drainage divides would be shifted as a result of not restoring precisely the pre-mining topography. This modification should be inconsequential.

Production of a shallow ground water supply that would be marginally usable would be a minor effect, as the present supply in the mine area is not used. Discharge of sodium sulfate water from the accumulating supply at a seep or spring would sustain some vegetation or would provide water for stock and wildlife. Mining and reclamation may in the long-term increase the amount of ground water available, but reduce the quality of the water.

Short-term use of the environment would be for the production of coal, during which nonrenewable coal resources would be permanently removed. The potential for long-term productivity would be reduced by the amount of coal removed, an additional 72.2 million tons totaling 98.6 million tons for the life of the mine in the project boundary, plus the amount of coal not recovered. The short-term unrecovered loss is about 15% plus the thin seams above the mined coal. This would add more than 22.2 million tons and would make the total coal committed about 120.8 million tons.

Significant long-term wildlife productivity losses are likely from mining in the Missouri breaks type habitat of the project area because of the difficulty of restoring complex vegetative communities. Shrubland and woodlands are ecologically more complex than grasslands. Grasslands composed of a few species may sustain domestic animals; however, wildlife species that are adapted to a variety of native grasses, trees, and shrubs may require all of these to maintain viable populations.

At present, there has been no known restoration of the hardwood draw type woodlands or natural shrubland communities, about 1.763 acres of which would be disturbed by the mining proposal. Although these habitats comprise only a small portion of the project area, their plant diversity makes them important to a disproportionate number of species of wildlife.

Difficulty in restoration of a habitat is increased with increasing varieties of plants in that habitat. If some plant species are not reestablished, certain animal species that depend on them would experience varying productivity losses, depending on their adaptability to the modified restored habitats and their ability to compete with other species of the remaining natural habitats. Because of the difficulty of restoring complex habitats needed by a large variety of wildlife species, the intermediate and long-term (4 to 20 years or more) wildlife losses would be measurably greater than those for domestic animals. The loss could amount to 50% or more for some species within the project area. The loss would be in proportion to the amounts of the crucial habitats not restored and may be measurable for 20 years or more.

Land use decisions that would reduce the acreage of woodland and shrubland would also reduce wildlife populations into the indefinite future.

Short-term use of the environment in the Glenharold mining area for the purposes of coal mining would destroy all long-term productivity of direct and primary impacted prehistorical and historical cultural resources. The information obtained during mitigation from the prehistoric and historic sites that would be impacted by the proposed action would be final. The sites could produce no further information following mining; they would cease to exist.

Mining coal over the short term (mine life) would result in continued jobs and income in the Mercer and Oliver County area and would enable the area which utilizes the energy to maintain or expand its employment, income, and production. Leasing of federal short-term coal would mean more coal could be mined, extending the life of the mine by five years.

Coal production at the Glenharold Mine would provide significant state and local revenues over the next 25 years as discussed in Chapter 3. However, if full pre-mining agricultural output is not restored through reclamation, a long-term economic loss of agricultural products would result. The loss would be relatively insignificant in its effect on total county agricultural production, but could severely impact the agricultural operations of individual surface owners.

Short-term use of the area will have little effect on the long-term productivity of recreation or air quality. Long-term hunting opportunities, however, may be diminished.

SHORT-TERM APPLICATION AREA

The short-term application area would extend the period of mining for five years, thereby extending short-term losses in recreation, aesthetics, air quality, and wildlife. The additional 983 acres of disturbed surface would extend short-term losses to soils, vegetation, water resources, wildlife, minerals, and cultural resources. Long-term productivity would be affected similarly to that of the entire project area.

Post-mining productivity for soils would increase within certain areas where silt material within the overburden is respead as topsoil to replace the present sandy material of low water-holding capacity such as exists in sections 14, 22, and 24. Increased estimates have not been quantified. Generally, the long-term productivity is closely dependent upon management of the reclaimed areas.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

PROJECT AREA

The major irreversible and irretrievable commitment of resources by the proposed mining would be the production for consumption of about 98.6 million tons of coal plus about 22.2 million tons of coal that would be lost during mining.

An undetermined amount of sand, gravel, and clinker would be required for concrete structures and haul roads. These resources would be permanently lost.

Soil losses, both from wind and water erosion, would largely be limited to the period during which the spoil material is bare, before seeding establishment. In a worst case situation, 211 acres would be bared--and therefore subject to wind and water erosion rates as discussed in Chapter 2--for a maximum of one year. These losses would be irretrievable.

As no wells are known to tap the ground water in the lignite or overburden that would be mined, loss of these beds does not constitute a significant commitment of the resources, even though it is irreversible. Ground water that could be developed in the mined area would be from the base of the spoil material or from deeper unmined aquifers.

Declines in deer, upland game birds, numerous non-game birds, and some furbearers may be measurable for 20 years or more depending on the time needed to restore forage quality, species diversity, and important shrub and woodland types. Potential land use decisions against restoration of these types would also influence the duration of impacts on wildlife. These long-term (20 years or more after reclamation) wildlife losses may significantly reduce hunting and other wildlife use opportunities on the project area.

Archaeological sites (both prehistoric and historic) are a non-renewable resource. With mitigation, a portion of the information in the known impacted sites can be preserved. However, the high cost of complete site excavations and the continuing improvement in archaeological methods make the possibility of the retrieval of all prehistoric and historic resource information highly unlikely, if not practicably impossible. Wherever archaeological sites are impacted, there will be a significant irreparable information loss.

The destruction or removal of fossils would be an irreversible commitment of resources.

The yearly irretrievable commitment of resources from coal mining at the Glenharold Mine would involve the labor and energy used annually for continued mining.

The North Dakota Energy Management and Conservation Office estimates that in 1980 each single family dwelling in North Dakota would require approximately 283 million British thermal units per year for heating and cooling. Similarly, the energy required for commuting to and from the job site would constitute an irretrievable resource commitment by those individuals employed at the mine.

Increased state and local revenues derived from continued mining at the Glenharold Mine would be utilized to finance public services and would thus be irretrievably committed during the life of the project.

The estimated loss of two human lives expected to occur as a result of continued mining at the Glenharold Mine (based on national statistics) would represent an irretrievable commitment of human resources.

SHORT-TERM APPLICATION AREA

The resources committed to the short-term application area are the same as those committed to the entire project. Specifically, 21.4 million tons of coal would be irretrievably committed. Soil eroded from the 983 mined acres would be lost. Some wildlife habitat and cultural resources could be irretrievably lost.

Chapter VIII

Alternatives to the Proposed Action

INTRODUCTION

This chapter discusses alternatives to the proposed action. The two alternatives presented are: (1) termination of mining, and (2) continued mining without federal coal. Other options are also discussed.

ALTERNATIVE NO. 1: TERMINATION OF MINING

The alternative of mining termination assumes that no additional federal coal would be leased, no additional Public Service Commission permits would be granted, and no county conditional use permits would be approved. The Public Service Commission and the Attorney General have expressed concern about the possible conflict between private property rights and the ability of regulatory actions to protect the public interest and welfare. Other assumptions used in the analysis of this alternative include:

1. The Leland Olds generating station would continue current production levels.
2. Alternate fuels (oil and gas) would not be used at the Leland Olds generating station.
3. 3.7 million tons of coal would be mined elsewhere to meet the needs of the Leland Olds generating station.
4. Without additional federal, state, or local approvals, mining at Glenharold will probably cease in 1980.

Termination of mining would require that the Consolidation Coal Company supply the Leland Olds plant with 3.7 million tons of coal per year from another of its lease holdings, or that a different coal supplier be found. A new mine source has not been identified. However, due to the transportation costs involved in shipping coal long distances and due to the location of the Leland Olds plant in an area of significant coal reserves, it could be reasonably assumed that the alternate coal supply would come from a location in Mercer, McLean, or Oliver Counties.

Climate and Air Quality

Termination of mining at the Glenharold Mine in mid-1980 would reduce particulate matter concentrations resulting from mining activities within the project area. The air quality impacts related to this alternative cannot be addressed in the absence of the specific location(s) of mining operations which would provide the 3.7 million tons of coal necessary to meet the needs of the Leland Olds generating station.

Although the continued operation of the Glenharold Mine does contribute to the overall total ambient air quality loading of particulates, the air quality standards are not expected to be exceeded off the mine site. The air quality impacts, in contrast, from unknown alternate coal sources within the counties of Mercer, McLean, and/or Oliver may exceed ambient air quality standards depending on the location(s) of this mining with respect to other particulate matter emission sources.

The existing ambient air quality with respect to particulates in Mercer, Oliver, and McLean Counties is as outlined in Chapter 2. Air quality impacts, mitigating or enhancing measures, and other consideration related to this alternative cannot be addressed without knowing the location(s) of alternate sources of coal. Comparing the impacts of air quality from the Glenharold Mine with an unknown mine is not possible.

Geology

If the Glenharold Mine were to be closed when the coal is exhausted within the area for which permits presently exist, an additional area of about 200 acres would be mined, and the types of impacts described in the geology sections of Chapters 3 and 7 would occur within that area. The landforms would be changed; the bedding, coherence, and compactness of the bedrock would be obliterated; fractures in the coal mined and the natural overburden placement would be destroyed; 4.8 million tons of coal would be mined; and any fossils in the disturbed material would either be cast into the spoil piles or retrieved by collectors or by scientists for scientific studies.

The remaining 3,547 acres of the proposed mine area would not be disturbed and there would

be no incremental environmental impacts on the area. It would continue in its present condition, subject to further modifications by natural processes, the continuation of other existing activities and uses, and any future use that the surface owners may decide.

About 68 million tons of minable coal would remain in the ground and be available for exploitation at some future time. The geologic impacts that would have accrued as a result of mining that amount of coal in the Glenharold Mine would then occur, to a lesser or greater degree, if the coal were to be mined elsewhere in Mercer, McLean, or Oliver Counties. If that too were denied, and if the Leland Olds plant is to continue operations, 3.7 million tons of comparable coal would probably have to come from some other part of the state.

Any fossils that presently lie concealed in the bedrock formations would remain pristine subject only to the slow depredations of time and the elements. However, fossils that may be present in any alternate mining area would be subject to the same impacts, adverse and beneficial, that might occur in the Glenharold Mine area.

Soils

With termination of mining, soil disturbance would not occur, and impacts described in Chapter 3 would not happen. Mining of coal reserves already leased would continue until mid-1980, at a rate of 155 to 211 acres disturbed each year. Impacts as described in Chapter 3 would remain as discussed for this acreage, and mitigation as detailed in Chapter 4 would be applicable.

Water

Intermittent streams that drain the mine area would not be interrupted or diverted around new mining pits or spoil piles. They would not be relocated over replaced soil and spoil, and their gradients would be unchanged. Consequently, their sediment and chemical loads would not be increased.

Ground water in the consolidated aquifers below the mined beds would be unaffected by cessation of mining. The beds in the Tongue River Formation that would have been mined are poor aquifers at best. They would not be improved or destroyed. Impacts that have been generated by past and present mining would continue to be felt. Such accumulation of ground water in and at the base of the spoil piles and the replaced spoil that has begun would continue, with possible movement of water into adjacent unmined lignite or sandstone strata. Water from the spoils would likely continue to be of less desirable quality than water that has not been routed through the debris.

Vegetation

Vegetative land cover would continue to be disturbed at an average rate of 211 acres per year until 1980. Reclamation efforts would continue until at least 100% of previous productivity had been reached.

The project area is primarily agricultural with the growing of grain crops and cattle grazing being the primary enterprises. After mining has ceased, this situation would be expected to remain with market and climatic conditions dictating to what intensity these farming enterprises would proceed.

The impacts to the vegetative resources of the project, if further leasing were denied, would be the same as those described for the proposed action, until mining ceases in 1980. After 1980, the impacts to the vegetation of the project area would be primarily those associated with agriculture such as soil erosion due to cultivation and over-grazing. Heavy grazing may cause hardwood draws to weaken and deteriorate.

Loss of native shrublands, woodlands, and grasslands to the mining process would be stopped if leasing were denied. Need for specialized management of the land cover after reclamation in order to prevent losses of its reclaimed productivity would be reduced.

Animals

Impacts upon wildlife habitat, and therefore to wildlife, would probably be significantly reduced under the cessation of mining alternative. This conclusion is based on the premise that if mining ceased in the Missouri River breaks (where the Glenharold Mine is located), coal would be supplied to Leland Olds from another mine, which would probably be less environmentally sensitive.

Under this alternative, the potential loss of 324 animal unit months of forage would last only two years, instead of eight, before it tapered off as reclamation reached completion. The potential dis-

ease problem discussed in Chapter 3 would be even less likely to develop under cessation of mining.

Consolidation Coal Company presently controls minable blocks of coal in four areas. Two of these, the Dakota Star and Renner's Cove tracts, are in Mercer County, and the other two, the Underwood and Washburn areas, are in McLean County. These mines are slated for opening in the 1980s. Markets have not yet been found for the coal from these areas, but it is likely that it will be exported, rather than utilized in mine mouth plants.

It is reasonable to assume that if mining ceased in the Glenharold area, Consolidation Coal Company would attempt to supply Leland Olds from one of these mines. If so, disturbance of native woodlands would decrease. The Glenharold area is 16% covered by native woody vegetation (mostly in hardwood draws). In contrast to this, the Dakota Star area is .5% woodlands, the Renner's Cove area is .6%, the Washburn area is 4%, and the Underwood area is 0%. Also, the woodlands are localized in the latter four areas, while at Glenharold the pattern is of a fairly even distribution all across the area. Any mining done at the Glenharold Mine is in proximity to wooded draws, while at the other four sites mining would be much less likely to encounter such areas.

Prehistoric and Historic Features

If mining were to terminate at the Glenharold Mine, present federal, state, and local permits would allow mining to continue in several areas (Maps 1-4 and 1-5 in Chapter 1). Three identified prehistoric and historic sites could still be impacted. These include the Serr Coal Mine, Section 13, T. 144 N., R. 85 W.; a prehistoric linear mound site, 32-ME-105, in Section 19, T. 144 N., R. 84 W.; and the Barlow Coal Mine, Section 4, T. 143 N., R. 84 W. (Map 2-8 in Chapter 2). These sites have already been fully analyzed for impacts, mitigation, and residual impacts in Chapters 3 through 5. Sites occurring in other parts of the project might be preserved from mining impacts.

Assuming that 3.7 million tons of coal per year would be mined elsewhere in Mercer, Oliver, or McLean Counties to fuel the Leland Olds generating station, the location of primary impacts would be shifted. Primary impacts related to construction and mining would probably occur at any new mining site opened. Any ground disturbance at a prehistoric or historic site would destroy that site. Since the inventory of prehistoric and historic features is incomplete over much of this three-county area, it is impossible at this time to determine the exact nature of the impacts on this resource. Inventory followed by evaluation of prehistoric and historic sites found would have to occur before the impact on the coal company concerned since this cost would have to be assumed by whichever coal company provided the coal for the Leland Olds generating station.

Aesthetics

There would be no further visual impacts on the proposed site with this alternative. The quality of the environment could be improved or enhanced, assuming that such intrusions as the tipple, office building, and warehouse and wareyard were removed and relocated since these would no longer be needed at the site.

However, the visual impact of this alternative cannot be fully assessed because 3.7 million tons per year of coal would be mined elsewhere. The visual contrast or impact depends on the location, size of the mining development, and the landscape type in which the mining occurs. Depending on the foregoing factors, the alternate coal mine might have greater or lesser visual impact than the proposed action.

Sound levels would return to premining conditions at the Glenharold Mine. Primary sound sources would become agricultural equipment, cattle, wind, insects, and occasional automobile traffic. Sounds from equipment operation and blasting at the Glenharold Mine would cease. Residents in the Glenharold area would not be impacted by intrusive sound. Sounds associated wtih mining would be relocated and other residents would probably be impacted.

Odors would also return to premining conditions at the Glenharold Mine. Odors from livestock, dust, agricultural chemicals, petroleum distillates, and operation of farm machinery and motor vehicles would remain, as they are associated with rural environments. Odors from mining activities would become less and less apparent as time passes. The odors associated with mining would be relocated elsewhere.

Recreation

Assuming that mining can continue through mid-1980 and reclamation may not be complete until 1985, the sights and sounds of mining would continue to affect hunting, tourism, and historic appreciation until 1985. Termination of reclamation activity after 1985 would allow a higher quality recreation experience at Knife River Indian Villages National Historic Site. The Lewis and Clark National Historic Trail, if approved by Congress, and recreation on the Missouri River would experience similar benefits. The extent to which recreation and tourism would be enhanced would depend, in part, on the success of reclamation. Because 3.7 million tons of coal would be mined elsewhere, the total impact of this alternative is difficult to measure. Impacts on recreation at another mining site would depend on mine location, size, and steps taken to mitigate environmental impacts.

Loss of hunting opportunities would be substantially less than produced by the proposed action under this alternative. Depending on the success of reclamation, wildlife populations would re-establish themselves more rapidly than with the proposed action. Therefore, fewer opportunities for consumptive and non-consumptive uses of wildlife would be lost.

Economic and Social Conditions

Cessation of mining at the Glenharold facility would have immediate implications with respect to the gross business volume in the two county area. Based upon Consolidation Coal Company's estimates for Glenharold's 1976 annual payroll and company expenditures in the project area ($2,948,000 and $374,974, respectively), it is estimated that gross business volume in the state would decline by approximately $9.9 million per year (see Appendix 8, Figure 1 for methodology).

Assuming that Glenharold's output of 3.7 million tons per year would be produced somewhere else in the two county area would result in a comparable dollar value increase in gross business volume initiated somewhere within the Mercer and Oliver County study area. A lag in economic activity may exist between cessation at Glenharold and a comparable extraction rate elsewhere, depending upon whether a new facility is developed or an existing facility is expanded.

The relocation of workers (both direct and indirect) and their dependents due to the cessation of activity at Glenharold would relieve some of the burden on existing public services where they now reside. This, however, may increase the burden of financing public services on those who decide to remain. The amount of the relief on public service demand or of the increased financial burden would depend upon the number of people who decide to relocate. It is estimated that approximately 369 direct/indirect employees and their dependents would relocate as a result of mine closeout. Some of the professional mining company employees (mining engineers, for example) may move entirely outside the two county study area in response to opportunities elsewhere in North Dakota or the nation. It is possible that some of the relocating blue collar workers would find employment with other coal companies in the two county area.

The share of the state severance tax revenues being returned to the Mercer County general fund, the cities, and school districts from mining at the Glenharold Mine would be lost if mining were to cease after 1980 and production were to be switched to Oliver or McLean Counties. Lost revenues from this source in Mercer County would need to be derived from other sources such as an increase in local property taxes. Conversely, Oliver or McLean County and their cities and school districts would benefit from the increased revenues.

Land Use

Cessation of mining at the Glenharold Mine would be environmentally beneficial by ending disruption of existing land uses, particularly forest/wooded lands by eliminating soil losses due to water and wind erosion; and by averting the risk of diminished surface and ground water quantity or quality. But, since this alternative postulates a replacement coal supply elsewhere in nearby counties, the cessation of mining would only shift these impacts to another location. Rather than allow for continued concentration of mining and generation impacts at the Stanton site, this alternative would further disperse impacts and disruption of agricultural operations as substitute mining facilities are constructed. A new mine would also change commuting patterns of employees and would require new haul roads, tipple, rail spurs, and a new transmission line to supply electricity to the mine.

ALTERNATIVE NO. 2: CONTINUED MINING WITHOUT FEDERAL COAL

Map 8-1 shows the areas most likely to be mined if a decision was made not to lease additional federal coal in the project area. Continued mining would occur only on non-federal coal and existing federal leases. Because federal coal ownership includes only the subsurface, some disturbance of the surface over federal coal would probably occur due to haul roads and topsoil stockpiling. Total non-federal coal reserves in the project area include an estimated 49.2 million tons of recoverable coal beneath approximately 2,162 acres. Based on a production rate of 3.7 million tons per year, the estimated non-federal coal reserves in the project area would last through mid-1992. As discussed earlier, additional approvals by state and local governments would be necessary for continued mining in this manner. A general assessment of the impacts of no additional federal coal leasing in the project area follows.

Climate and Air Quality

Continued mining within the project area of coal from non-federal coal reserves would result in no air quality related considerations other than those outlined in previous chapters.

Geology

Continued mining in the Glenharold Mine area without federal coal would result in the continuation of the geologic impacts discussed in the "Termination of Mining" section of this chapter. For example, about 139 acres of land that overlies federal coal in Section 32, T. 144 N. R. 84 W. would be left isolated representing about 2.8 million tons of coal might not be mined in the future because of economic considerations. If coal extraction were to cease 20 feet short of the section line, about 52,000 tons of privately owned coal would be left with the federal coal.

Soils

Continued mining, incurring impacts as discussed in Chapter 3, would disrupt an additional 155 to 211 acres annually through mid-1992. Some impacts as described in Chapter 3 also could occur over federal coal reserves, because of haul roads and stockpiling of topsoil and subsoil. Therefore, impacts on soil would not substantially change with removal of federal coal reserves from leasing.

Water

If mining of federal coal were to be denied, the draw that extends from Section 24 to Section 14, T. 144 N. R. 85 W., would not be mined out and hence would not contribute sediment to its unnamed master intermittent stream and the valley of the Knife River. Other draws in Section 24 similarly would not be disturbed. Denial of mining in Sections 20, 30, and 32, T. 144 N. R. 84 W., would eliminate sediment additions from surface runoff to the Missouri tributaries that drain them (Map 2-9 in Chapter 2).

Denial of mining of federal coal would not change the impacts on ground water in the Glenharold area from what they would be if the proposed mining plan were to be approved.

Vegetation

The alternative of no leasing of federal coal would delete about 39% of the mining plan from potential mining. This 39% contains 44.6% of the mining plan's cropland, 38.3% of its grassland, 31.5% of its shrublands, and 45.4% of its woodlands.

The no leasing of federal coal alternative within the project area would probably reduce the impacts to vegetation in Chapter 3 by about 30% although there would probably be more disturbance of vegetation due to additional haul roads needed; the failure to lease federal coal would create a less logical mining sequence.

The same impacts would probably occur with the leasing of federal coal as without, but the degree to which the impacts would be felt would probably be reduced by about one-third.

The mitigating measures for the no leasing of federal coal would be the same as discussed in

Chapter 4, Vegetation, for the proposed action. More emphasis, however, would be required on those measures which mitigate impacts of the haul roads that would likely cross areas of federal coal which would not be leased.

Animals

Continued mining without federal coal would reduce impacts on wildlife, since mining would end six years ahead of schedule. Some of the privately owned surface over the federal coal could be disturbed in the course of the mining of the adjacent non-federal coal. Therefore, impacts under this alternative may not be reduced in proportion to the reduction of mined land. Impacts on domestic animals and wildlife under this alternative probably would be intermediate between those resulting from the proposed action (Chapter 3) and those from the Cessation of Mining alternative.

The extent to which the surface over unleased federal coal would be disturbed by haul roads, construction, and other factors is difficult to predict. If there is no such disturbance and the federal coal is not leased, habitat disruption would be decreased by the following percentages: cropland 45%, grassland 38%, shrubland 32%, woodland 45%. The aggregate reduction in surface disturbance would be 39%. Thus, animal losses which would come as a result of the proposed action would decrease by about 39% if no additional federal coal were leased.

Prehistoric and Historic Features

Even without leasing federal coal, known prehistoric and historic sites in the Glenharold Mine project area would be impacted. The historic Serr Coal Mine and other possible unnamed mines in Section 13, T. 144 N. R. 85 W., are presently being destroyed and would continue to be destroyed. Site 32-ME-117 in the S 1/2 of Section 19, T. 144 N. R. 84 W., and the sites in the Oliver County portion of the project area over private coal would also be disturbed.

These are sites known from inventory within the Glenharold project area. However, most areas outside of the probable mining area have not been inventoried for cultural remains. Impacts could occur outside the mining area to sites presently unidentified.

Impacts might discontinue on four presently known sites if federal coal is not leased. These are the Teuber Coal Mine, the Teuber farmstead, the historic burials (32-ME-140), and Barlow Coal Mine (Map 2-8 in Chapter 2). The first three sites are in Section 24, T. 144 N. R. 85 W., the Barlow Coal Mine is in Section 4, T. 143 N. R. 84 W. Although these sites would not be impacted by actual mining, they could be impacted by spoil piling, road building, or topsoil stockpiling because the surface is in private ownership.

Aesthetics

Rather than concentrating the noise, dust, sight, and other environmental impacts within the confines of the existing project area, the withholding of federal coal would diffuse mining impacts by compelling new or expanded production elsewhere in order to supply the 3.7 million tons burned yearly at Basin Electric's Leland Olds Station. The sound environment and impacts under this alternative would be very similar to those for the proposed action. Likewise, odors would be similar to those of the mining proposal.

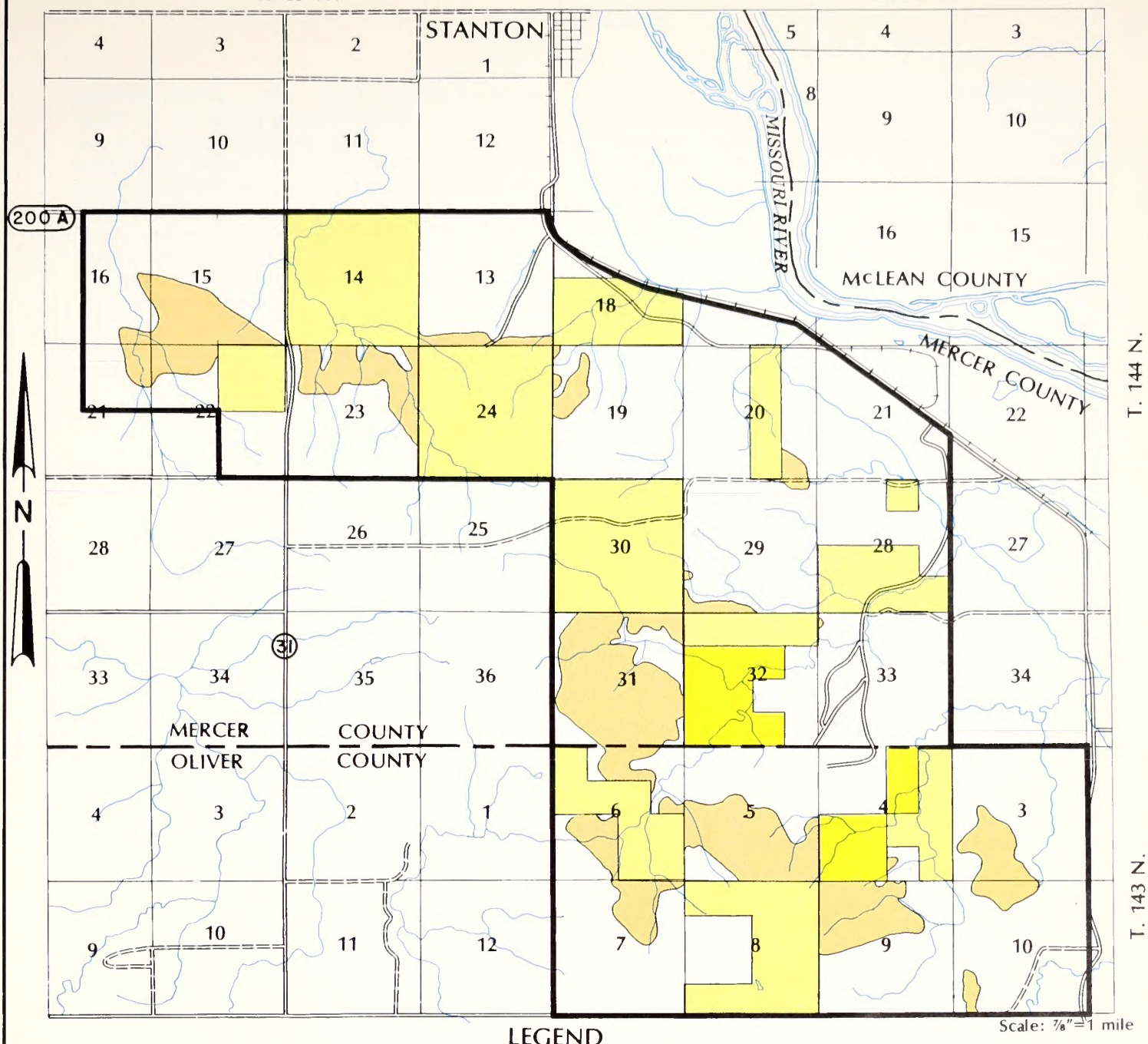
Recreation

The impacts on recreation would be similar to impacts discussed for the proposed action through 1997. Even though federal subsurface would not be mined, the surface could be disturbed by haul roads, spoil piles, topsoil storage, dust, loss of vegetation, and noise. These disturbances could cause losses of recreation opportunities for hunting and wildlife observation. The sounds and sights of mining would continue to lower the quality of recreation experiences on the Missouri River and at nearby historic sites. In the long term, this alternative could be more disruptive to recreation values (than the proposal) due to the sprawling nature of a mine omitting federal coal.

Economic and Social Conditions

Non-lease of the federal coal at the Glenharold Mine site could result in permanent economic loss from non-utilization of this resource. If by-passed coal deposits were mined at a later date, it would probably not be economically feasible. Additionally,

MAP 8-1



LEGEND

- Improved Roads
- Other Roads
- Railroads
- County Boundary
- Glenharold Mine Project Area Boundary
- Stream
- Private Coal Reserves
- Non-Leased Federal Coal
- Leased Federal Coal

SOURCE: Kesterke 1977

MINING AREA WITH NO FEDERAL COAL LEASING

potential royalty, which would amount to at least 12.5% of the selling price of federal coal, would be lost if the coal were not leased and mined. It is estimated that up to 23 million tons of federal coal could potentially be leased for mining. Utilizing a 1977 average selling price of $4.40 per ton, lost royalty collections could total over $13 million. No federal royalty would be collected if the 3.7 million tons per year of coal were to be mined from an area where no federally owned coal was mined. Of the 50% share which the federal government and the state of North Dakota would otherwise each receive would be lost.

Land Use

The 2,162 acres of private coal which still could be mined have land use distribution percentages similar to those of the entire mining plan. A decision not to lease federal coal would reduce the amount of cropland disturbed by 858 acres but would also accelerate the expansion and dispersal of substitute mining activity elsewhere, perhaps affecting a greater percentage of agricultural land.

ALTERNATIVE NO. 3: LEASING AT A LATER DATE

All of the minable surface within the short-term lease application area has been circumvented or will have been by 1980. A typical mining operation would have mined most of the federal coal in the application area by now if the coal had been leased. Even if the short-term area is leased in the near future, some additional surface redisturbance would occur.

A recent company's mining proposal shows all recoverable private coal being mined in the northwest area of the project boundary first and then moving toward the southeast. Once the area within the project boundary is mined, it would be almost impossible to return to the coal within a short-term area without significantly increasing environmental damage to the area.

Removal of coal from the short-term application area at a later date or after partial or complete rehabilitation has occurred would result in additional environmental disturbance associated with; reopening of pits, reconstruction of pits inclines, reconstruction of coal haul roads, water diversion structures, and sediment control structures on lands previously rehabilitated. Redisturbance of rehabilitated lands would involve 700 to 800 foot wide areas adjacent to the new pits. Within Section 14, a 3,500 foot zone adjacent to previously mined land in Section 13 would be involved in addition to 4,500 feet of highwall and 3,000 feet of endwall which would be repeated. In Section 22, approximately 2,600 feet of final pit would occur adjacent to lands reclaimed in Section 15. In Section 20, a similar 2,500 foot zone would be involved as would a 1,200 foot zone along Section 29 for mining of federal coal reserves in Sections 30 and 32 and redisturbance along Section 31 in mining of Section 6.

Redisturbance will expose soils and stockpiles, suitable plant growth material to erosion hazards. Rehandling of suitable plant growth material would potentially impact soil fertility. Revegetation would have to be reinitiated. Pit inclines would have to be reinstalled along the eastern edge of Section 13. Two inclines over reclaimed land would be placed in Section 15. Sediment ponds would have to be reinstalled to provide sediment control for each incline area. Spoils and topsoil storage would disturb reclaimed land within Section 15. Haul road reconstruction over reclaimed land would be involved in Sections 13, 14, and 15. Coulee, fills, and a dragline grade would have to be reconstructed in Section 13. A haul road underpass presently beneath Highway 31 in Section 15 would have to be reconstructed when Section 22 federal coal reserves are mined at a later date.

Leasing at a later date would be beneficial to wildlife because (1) wildlife could use the habitat on the short-term application area during the period from now until they are actually used, and (2) the area would serve as islands of undisturbed habitat during the reclamation period, thus increasing the overall suitability of the area for species with large home ranges such as white-tailed deer and raptors. If the interval between mining periods were long enough, reclamation may have proceeded far enough on the initially mined areas for the entire area to retain its generally suitability during the second mining period.

If leasing was delayed, the applicant would have a longer period of time to accomplish the necessary cultural resource inventory.

The visual impact of this alternative would vary little from the proposed action because the area of highest impact would still be seen from Highway 200A. Visual impacts would occur for a longer period of time and could be a major impact as the Knife River Indian Villages National Historic Site became an important visitor attraction.

Tourism is likely to increase in the future and the adverse visual impacts are likely to be viewed by more people over a longer period of time. As the mined out areas are to be reclaimed, the delayed by-pass areas would prolong the adverse visual impacts of surface mining. Likewise for sound and odors, the impacts would be prolonged over a greater period of time.

Postponement of leasing in the short-term application areas would cause a temporary loss of coal severance tax revenues and federal royalty to the State of North Dakota.

The same or greater increases in environmental damage would occur should someone other than the applicant successfully obtain a lease. It is unlikely that Consolidation would share existing facilities with another company so new facilities such as water wells, tipple, shop, office facilities, and haul roads would be needed. It is not likely that someone other than the company would obtain a short-term lease should the area be leased, since the federal coal does not constitute a logical mining unit.

REGULATORY OPTIONS BY GOVERNMENT

Government agencies at the federal, state, and local levels have regulatory authorities involving most phases of a mining operation. These regulatory operations could significantly modify future mining activities at the Glenharold Mine. An action at one governmental level does not occur without affecting or being affected by actions at other governmental levels. For example, North Dakota Public Service Commission mining permits and county conditional use permits are applicable to both federally owned and privately owned coal.

The Department of the Interior can offer specific tracts of federal coal for lease, and can place stipulations in those leases based on environmental or social concerns. Such stipulations must be reasonable and, if economically unacceptable to the potential lessee, could result in his not developing the coal resource.

In addition to leasing of federal coal as discussed in the proposed action, or leasing of no federal coal, the Department of Interior has an additional option. The Bureau of Land Management could modify significantly the short-term lease applications based on completion of the Bureau's land use planning analysis and the anaysis of impacts and potential mitigating measures suggested in this environmental impact statement. Before active mining of federal coal in the short-term area can begin, a lessee's mining plan must be approved by the Office of Surface Mining in consultation with the Geological Survey and BLM.

OTHER OPTIONS

Alternate energy sources, energy conservation, and alternate mining technologies were considered but appeared unrealistic. Alternate energy sources considered include the conversion of the Leland Olds Power Plant to natural gas or oil. It does not seem reasonable to convert the power plant to oil or gas in context of the current oil and gas situation especially when considering the limited additional environmental disturbance that would occur in an active mining area.

Energy conversion embraces a wide range of actions, both in the production and consumption of energy. At the production end, energy conversion can be made more efficient, improvements in fuel extraction processes can be implemented, and the potential for improved efficiency in electrical generation exists. Conservation of energy at the point of use will receive increasing attention as energy costs rise and fuel supplies become limited. Energy conservation is a major component of the national energy program; however, it is highly unlikely that energy conservation will create a significant decrease in demand for electricity from the Leland Olds plant.

Alternate mining technologies such as underground mining and auger mining do not appear to be realistic in the Glenharold area. The primary reason for underground mining is that it is the most economical method of extracting coal when producing seams are located at greater depths. In the Glenharold area, depths of coal are relatively shallow and the seams are relatively thin. Underground mining would reduce the recoverability of the coal reserves from 85% by surface mining to less than 50%. Two small underground mines operated in the project area during the 1920s and one continued through 1944; however, underground mining currently is not economical. Auger mining cannot extend further than 300 feet into the working face. Coal beyond this point would be left unmined. Only about 60% recovery would be realized. Because of the size and depths of the coal seams in the Glenharold area, both underground and auger mining would unnecessarily preclude the complete removal of the available coal reserves.

Chapter IX
Consultation and Coordination

For details of project organization, intergovernmental participation, and public involvement, see page 205 of the draft West Central North Dakota Regional Environmental Impact Study on Energy Development.

This Technical Examination and Environmental Assessment (TEEA) is a site-specific analysis done in conjunction with the Regional Study, with additional sections added on for the short-term application area. Staff assignments for the TEEA were as follows: Overall Project Coordinator, Lloyd Emmons; Scientific Reviewer, Bill Frey; Climate and Air Quality, North Dakota Department of Health; Geology, Bill Frey; Soils, Larry Pointer; Vegetation, Lloyd Emmons; Water, William Hopkins and Tom Yochem; Animals, Holden Brink; Leisure Pursuits and Values, Alan Kesterke and Dwight Araki; Economic Conditions, Loren Cabe; Social Conditions, Loren Cabe; and Land Use, Lloyd Emmons.

In addition to the consultation and coordination listed in the draft Regional Study, the following contacts were made during the preparation of the TEEA:

Climate and Air Quality

None

Geology

None

Soils

None

Water

Consolidation Coal Company

Roy Woody

Vegetation

North Dakota Public Service Commission

Dean B. Peterson

Consolidation Coal Company

Ted L. Hanks

Rich Williamson

Animals

None

Leisure Pursuits and Values

None

Economic and Social Conditions

None

Land Use

None

Appendix

Appendix to Chapter 2

DOMESTIC ANIMALS POPULATIONS OF MERCER AND OLIVER COUNTIES

	CATTLE			HOGS		
County	5 year average	1975	1976	5 year average	1974	1975
Mercer	64,000	70,000	69,000	5,000	4,000	4,100
Oliver	38,000	42,000	40,000	6,200	5,000	6,000

	SHEEP		HORSES	CHICKENS
County	5 year average	1975	1974	1974
Mercer	2,400	1,900	300	10,700
Oliver	2,900	2,800	300	9,300

SOURCE: North Dakota Crop and Livestock Reporting Service 1976

APPENDIX 2, TABLE 1

HABITAT UTILIZATION INDICES FOR THE SMALL MAMMALS PROBABLY OCCURRING ON THE PROJECT AREA

Species	Habitat Type				
	Woodlands	Grasslands	Shrublands	Croplands	Wetlands
Masked Shrew	2	2	2		3
Little Brown Myotis	2	3	2	3	3
Big Brown Bat	2	3	2	3	3
Eastern Cottontail	1		1	3	
Least Chipmunk	1		2		
13-Lined Ground Squirrel		1		2	
Northern Pocket Gopher		1	2	1	
Olive-backed Pocket Mouse		1			
Hispid Pocket Mouse		1			
Western Harvest Mouse		1	1		
Deer Mouse	1	1	1	1	3
White-footed Mouse	1				
Northern Grasshopper Mouse		1	2	3	
Northern Red-backed Vole	1		1		
Meadow Vole	3	1	3	3	3
Prairie Vole		1	3		
Norway Rat	----------Farmsteads----------				
House Mouse	----------Farmsteads----------				
Meadow Jumping Mouse	2	2	2	3	2
Porcupine	1		2	3	
Indices[1/] Summary: "1s"	6	9	4	2	0
"2s"	4	2	8	1	1
"3s"	1	2	2	7	5

1/ The indices are as follows: "1" - The particular species obtains all or most of its habitat requirements from the given habitat; "2" - The particular species is heavily dependent upon the given habitat and is able to obtain most of its requirements from it; and "3" - The species uses the habitat to satisfy only a small part of its habitat requirements.

SOURCE: Hibbard (1972), Montgomery (1975), and personal communication with J.F. Cassel and J.M. Wiehe, NSDU, Fargo. All common names are those used by Jones et al. (1975).

HABITAT UTILIZATION INDICES FOR OTHER NON-GAME BIRDS PROBABLY OCCURRING ON THE PROJECT AREA

Species	Habitat Type				
	Woodlands	Grasslands	Shrublands	Croplands	Wetlands
Mourning Dove	1	1	1	1	1
Black-billed Cuckoo	1		2		
Common Nighthawk	1	1	1	1	
Common Flicker	1	2	2	2	
Red-headed Woodpecker	1				
Hairy Woodpecker	1				
Downy Woodpecker	1				
Eastern Kingbird	1	1	1	1	
Western Kingbird	1	1	1	1	
Great-crested Flycatcher	1				
Least Flycatcher	1	3	1	3	3
Horned Lark		1	1	1	3
Bank Swallow	2	3	2	2	2
Barn Swallow	2	3	2	2	2
Purple Martin (urban)	2	2	2	2	2
Blue Jay	1				
Black-billed Magpie	1	1	1	2	
Common Crow	1	1	1	2	
Black-capped Chickadee	1				
White-breasted Nuthatch	1				
House Wren	1	2	2	1	
Rock Wren		1	1	3	
Gray Catbird	1	2	1	2	
Brown Thrasher	1	2	1	2	
American Robin	1	1	1	1	3
Swainson's Thrush	1				
Veery	1				2
Eastern Bluebird	1	2	1	2	
Cedar Waxwing	1				
Loggerhead Shrike	3	1	1	1	
Starling	1	1	1	1	
Bell's Vireo	2		1		
Yellow-throated Vireo	1				
Red-eyes Vireo	1				
Warbling Viero	1				
Black and White Vireo	1				
Yellow Warbler	1				
Blackpoll Warbler	1				
Overbird	1				
Common Yellowthroat	1		1		1

Species	Habitat Type				
	Woodlands	Grasslands	Shrublands	Croplands	Wetlands
Yellow-breasted Chat	1				
American Redstart	1				
House Sparrow	1	1	1	1	1
Bobolink		1	2	1	
Western Meadowlark		1	1	1	1
Yellow-headed Blackbord		3		2	1
Red-winged Blackbird		1	2	1	1
Nortern Oriole	1				
Brewer's Blackbird		1	1	1	1
Brown-headed Cowbird	1	1	1	1	1
Black-headed Grasbeak	1				
Lazuli Bunting	1		1		
American Goldfinch	1	1	1	1	
Rufous-sided Towhee	1				
Lark Bunting		1	1	2	
Savannah Sparrow		1	1	1	
Grasshopper Sparrow		1	2	2	
Vesper Sparrow		1	1	1	2
Lark Sparrow	1	1	1	1	3
Chipping Sparrow	1		1	2	3
Clay-colored Sparrow	1		1	2	
Field Sparrow	1	1	1	2	
Song Sparrow	1	2	1	2	2
Chestnut-collared Longspur		1	2	2	
Indices[1/] Summary: "1s"	47	25	31	19	8
"2s"	4	9	10	17	6
"3s"	1	2	0	2	5

1/ The indices are as follows: "1" - The particular species obtains all or most of its habitat requirements from the given habitat; "2" - The particular species is heavily dependent upon the given habitat and is able to obtain most of its requirements from it; and "3" - The species uses the habitat to satisfy only a small part of its habitat requirements.

SOURCE: Hibbard (1972) and personal communications with J. Frank Cassel, NDSU, Fargo. All common names are those recognized by the American Ornithologist's Union. Some winter visitors may not be included in the table.

AMPHIBIANS (Left) AND REPTILES (right) LIKELY
TO OCCUR ON THE GLENHAROLD MINE PROJECT AREA

Tiger Salamander	Painted Turtle
Plains Spadefoot	Plains Garter Snake
Great Plains Toad	Red-sided Garter Snake
Rocky Mountain Toad	Western Hog-nosed Snake
Chorus Frog	Racer
Leopard Frog	Smooth Green Snake
	Bull Snake
	Prairie Rattlesnake

SOURCE: North Dakota Department of Game and Fish and Hibbart (1972).

APPENDIX 2, TABLE 4

VISUAL RESOURCE MANAGEMENT

Scenic Quality

The scenic quality of the Glenharold Mine and environs was rated in accordance with the BLM Visual Resource Management Manual 6310. The scenic quality rating is based on the premise that all landscapes have value, but those with the most interest, variety, harmony, and contrast have the highest scenic quality. The Scenery Quality Inventory Chart (see Table 1) takes the key factors which are: landform, vegetation, color, water, uniqueness, and intrusions and assigns highest numerical values to the landscape types which displays the most interest, variety, harmony and contrast. The scenery units were evaluated on Form 6110-10 (see Table 2).

Each unit is described in terms of form, line, color, texture, and intrusions below. This description should act as an explanation of the rationale used to determine the evaluation of the scenery units.

Plains (C Average)

The land form of this unit, which is quite typical of this part of North Dakota, is flat to rolling plains with the dominant slopes ranging from 0 to 15 percent. This area is influenced by a strong rectilinear pattern emphasized by the grain crops which uses strip farming, a practice which gives a strong rectilinear form to the landscape.

As previously suggested, man-made or straight lines dominate the landscape as found in the farming practice. Other lines which could be included as man-made would be roads, fence lines, and power lines. An outstanding skyline is absent in this flat to rolling countryside.

Color in the vegetation is primarily a grass green and a golden brown. The types of vegetation include grain crops, corn, and prairie grasses. Most farm patterns alternate between some crop vegetation to fallow or bare soils. Color in most of the soils is gray, dusty brown when dry, or dark brown when wet. As winter comes to the plains, snow storms may blanket the ground with white.

Textures in the landscape vary from a fine to medium. The fine texture is found in the monoculture of the grain crops and prairie grasses and in the flat to smooth prairie topography. The medium texture may be used to describe the corn crops.

Intrusions in this part of the plains are the farm patterns previously mentioned. These, along with their associated fence lines and farm equipment in general, do not degrade the scene, but in some cases such intrusions are quite picturesque in the prairie landscape.

The most apparent intrusions in the plains part of the project are the old mine spoils. Some areas have even formed water impoundments and natural looking area.

Missouri River (A Excellent)

The Missouri River is comprised mainly of riparian vegetation. The riparian growth is composed primarily of cottonwood and willow with some ash, elm, and boxelder.

This vegetation lies in the river valley formed by rolling hills and steep bluffs. The edge pattern of the vegetation forms curvelinear green belts as these snake through the landscape.

Generally lines are natural or curvilinear. Tree tops form leafy domes on the skyline.

The color in the vegetation is a dark green as found in the primary vegetation in the draws with some shades of lighter greens in other varieties of species. Seasonal changes in fall color include golden yellows, especially in the elm, boxelder, and cottonwood. In winter, the scene changes to bleak colors of dark greys and browns as found in the branching structures of these deciduous trees and shrubs in the riparian environment.

Textures vary from medium to coarse in vegetation. Some interesting erosional patterns occur on the bluffs and cliffs along side the rivers and creeks.

A few old farm or ranch houses line the river and creeks. Two power plants at Stanton, the UPA and Basin, are highly visible from the river corridor. The form of these plants, and their stacks are a great visual contrast in the existing environment.

Scenery Quality Inventory Chart

KEY FACTORS	RATING CRITERIA AND SCORE		
1 LAND FORM	Vertical or near vertical cliffs, spires, highly eroded formations, massive rock outcrops, severe surface variation 4	Steep canyon walls, mesas, interesting erosional patterns, variety in size & shape of land forms 2	Rolling hills, foothills, flat valley bottoms 1
2 COLOR	Rich color combinations variety or vivid contrasts in the color of soil, rocks, vegetation or water 4	Some variety in colors and contrast of the soil, rocks & vegetation, but not dominant 2	Subtle color variations, little contrast, generally muted tones. Nothing really eye-catching 1
3 WATER	Still, chance for reflections or cascading white water, a dominant factor in the landscape 4	Moving and in view or still but not dominant 2	Absent, or present but seldom seen 1
4 VEGETATION	A harmonious variation in form, texture, pattern, and type 4	Some variation in pattern and texture, but only one or two major types 2	Little or no variation, contrast lacking 1
5 UNIQUENESS	One of a kind or very rare within region 6	Unusual but similar to others within the region 2	Interesting in its setting, but fairly common within the region 1
6 INTRUSIONS	Free from aesthetically undesirable or discordant sights and influences 2	Scenic quality is somewhat depreciated by inharmonious intrusions but no so extensive that the scenic qualities are entirely negated 1	Intrusions are so extensive that scenic qualities are for the most part nullified -4

Scenery A = 15-24

Scenery B = 10-14

Scenery C = 1-9

SOURCE: BLM Manual 6310, 1975

EXPLANATION OF RATING CRITERIA

1 Land Form or topography becomes more interesting as it gets steeper and more massive. Examples of outstanding land forms are found in the Grand Canyon, the Sawtooth Mountain Range in Idaho, the Wrangle Mountain Range in Alaska, and the Rocky Mountain National Park.

2 Color. Consider the overall color of the basic components of the landscape (i.e., soil, rocks, vegetation, etc.) as they appear during the high-use season. Key factors to consider in rating "color" are variety, contrast, and harmony.

3 Water is the ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

4 Vegetation. Give primary consideration to the variety of patterns, forms, and texture created by the vegetation.

5 Uniqueness. This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique within any one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing scenery — the uniqueness factor can be used to recognize this type of area and give it the added emphasis it needs.

6 Intrusions. Consider the impact of man-made improvements on the aesthetic quality. These intrusions can have a positive or negative aesthetic impact. Rate accordingly.

1. Date: August 1, 1976
2. Rater: Araki
3. State: North Dakota
4. District: Dickinson
5. Plan Unit: Mercer & Oliver Co.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

QUALITY EVALUATION SCORESHEET

6. Recreation Activity: Scenery Quality Inventory

CLASS	SCORE RANGE
7	
A	15-24
B	10-14
C	1-9

8. KEY FACTORS

9. RATING AREA NO. (a)	9. RATING AREA NAME (b)	Landform	Color	Water	Vegetation	Uniqueness	Intrusions			11. TOTAL SCORE	12. CLASS	13. REMARKS
	10. POINT MAXIMUM	4	4	4	4	6	2					
	Plains	1	1	1	2	1	1			8	C	
	Missouri River	2	2	4	2	6	1			17	A	
	Breaks Topography	4	2	1	2	2	2			13	B	

(Instructions on reverse)

Form 6110–10 (August 1972)

The Consol operational area is located in the river corridor. This area includes such facilities as the office building, loading facilities, and power station with the utility lines, and maintenance building.

Some mining is occurring within the river corridor; however, it cannot be seen from Highway 200A or the Missouri River.

Breaks Topography (B Good)

The Breaks topography are in areas of highly broken lands. This area is dissected by woody draw vegetation, particularly on the north facing slopes.

The landform of the Breaks topography is a series of buttes and bluffs. Erosion has carved many gullies and channels in this land form.

Line is a series of meandering and curvilinear hills and dales. For the most part it represents naturalistic landscape. Horizontal lines are also noticeable in the stratification of some of the buttes and bluffs.

Color, as primarily seen in the scattered grouping of hardwood draw species within the area, is dark green. The prairie grasses are a lighter green in the spring and turn to a golden yellow in the summer and autumn. Seasonal change in fall colors include golden yellows especially in the elm, boxelder, and cottonwood. The winter scene changes to colors of dark greys and browns as found in the branching structures of the deciduous trees scattered within the area. At times during the winter this is contrasted by the white snow on the ground. The soil colors are tones of light yellows and tans as found in the bluffs and buttes.

Texture, because of the erosional pattern in the buttes and bluffs, is rough and rugged. Vertical rills and dendritic patterns on some bluffs are evident and contrast with the horizontal stratification to form interesting visual textures. Fine to medium textures are reflected in the vegetation.

Very few intrusions are to be found in the Breaks topography. Noticeable exceptions are fence lines, occasional ranch houses, and some agricultural uses. Because of the topographic variations in the landscapes, many of these intrusions are not seen as one moves through the Breaks topography.

Visual Sensitivity

The visual sensitivity level analysis was determined by the procedure described in BLM Manual 6310. The visual sensitivity level is an index to the relative importance of the visual response within the area. Three areas of different visual sensitivities have been identified. These areas were determined by various major roadway corridors and were mapped on Map 2 in the main text. Areas were analyzed and rated as high, medium, or low visual sensitivity levels. The results of the analysis were as follows:

Area within the visual corridor of State Highway 200A--High

Area within the visual corridor of State Highway 31--High

Area outside the visual corridor of major highways--Low

The criteria selected for the analysis were: use volume--cars, use volume--lake and river, use association, community attitudes, land-use (coal companies), other agencies use and attitudes, and snowmobiles and off-road vehicles (ORV).

These criterions were measured against one another as to which is more important in order to determine what the relative weighting of the criteria should be on Table 3. In determining which factor was more important, the question was asked, "Which user's attitude will be more sensitive to visual change caused by coal leasing activities?" The resultant weighting and the determining significance of each criterion is shown on Table 4. The scores or ratings were tallied on Form 6110-10, Table 5.

The definition or meaning of each criterion with what factors in each area of visual sensitivity were considered are described in the following paragraphs:

Use volume--cars is the number of vehicles on various travel corridors or average daily traffic from the 1974 North Dakota Traffic Report. Travel in the visual sensitivity areas is as follows:

Area within the visual corridor of State Highway 220A--1,000-1,500

Area within the visual corridor of State Highway 31--350-370

Area outside the visual corridor of major highways--NA

Use volume--lake and river is the visits per year of users of Lake Sakakawea and the Missouri River. Major travel routes to the points were considered high if more than 20,000 visitors traveled these routes to their destination of Lake Sakakawea or the Missouri River. The following data was used:

Format for Sensitivity Level Criteria Weighting[1]
Oliver, Mercer, McLean Counties

	Use Volume Cars	Use Volume Lakes and Rivers	Use Association	Rural Community Attitudes	Land Use (Non-BLM) (Coal)	Other Agency Use and Attitudes	Snowmobiles & ORV	Weight	
								Raw	Adjusted[2]
Use Volume Cars		←	↑	←	←	↑	←	4	5
Use Volume Lakes and Rivers			↑	←	←	↑	←	3	4
Use Association				←	←	↑	←	5	6
Rural Community Attitudes					←	↑	←	2	3
Land Use (Coal) (Existing & Proposed)						↑	↑	0	1
Other Agency Use and Attitudes							←	6	7
Snowmobiles & ORV								1	2

[1]Arrows indicate which of the two values being compared (such as the use volume of cars and trains versus the use volume of trails, rivers, etc.) is considered more sensitive in the area being rated. Based on a comparison of each sensitivity criterion against all others, a ranking of the importance of all values is obtained.

[2] If one or more elements should end up 0, add 1 to all weightings to prevent elimination of the criteria.

SOURCE: BLM Manual 6310, 1975

FORMAT FOR DETERMINING SENSITIVITY LEVEL

	OLIVER, MERCER & McLEAN COUNTIES						
CRITERIA & WEIGHT		HIGH		SENSITIVITY LEVEL MEDIUM		LOW	
(1) Use volume (total use, no distinction between types) cars and trains		Segments of travel routes, use sites or population centers which receive 200,000 or more visits/yr. or more than 200 vehicles/day (ADT year round), or comparable degree of use on a seasonal basis		Segments of travel routes, use sites or population centers which receive 20,000 to 200,000 visits/yr. or 20 to 200 vehicles per day (ADT year round), or a comparable degree of use on a seasonal basis		Travel route segments with less than 20,000 visits/yr. or less than 20 vehicles/day (ADT year round)	
Weight	5						
(2) Use volume — trails, rivers, water bodies		20,000 or more visits/yr		2000-20,000 visits/yr		Less than 2000 visits/yr	
Weight	4						
(3) use associaiton — primitive areas, observation sites, recreation areas, etc		Major		Secondary		Minor	
Weight	6						
(4) Rural Community relationships and attitudes		Protection of the visual resource is important				Portection of the visual resource is not important	
Weight	3						
(5) Coal land use in relationship to non BLM land use (Existing & proposed)		Critical				Not important	
Weight	1						
(6) Other agency use and planning attitudes		Major national or regional in scope		Secondary sub-region or state		Minor local	
Weight	7						
(7) Snowmobiles & ORV							
Weight	2						
TOTAL		High Use		Medium Use		Low Use	

INSTRUCTION: Check the column that most nearly applies, then add the weight to the column checked. The column with the highest weighted score indicates the sensitivity level that should be used.

SOURCE: BLM MANUAL 6310, 1975

1. Date: September 7, 1976
2. Rater: Araki
3. State: MSO
4. District: Dickinson
5. Plan Unit: Mercer & Oliver Co.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

QUALITY EVALUATION SCORESHEET

6. Recreation Activity: Sensitivity Level

CLASS	SCORE RANGE
	7
High Medium Low	Highest Total Points Determine Level

8. KEY FACTORS

9. RATING AREA NO. (a)	9. RATING AREA NAME (b)	10. POINT MAXIMUM: Car 5	Lake 4	Use Assoc. 6	Comm. Att. 3	Land Use 1	Other Agen. 7	Snowmo.-ORV 2		11. TOTAL SCORE	12. CLASS	13. REMARKS
	Area within the visual corridor of St. Hwy. 200A										H	
	High	5	4	6			7			22		
	Medium				3	1				4		
	Low							2		2		
	Area within the visual corridor of St. Hwy. 31										H	
	High	5	4	6						15		
	Medium				3		7			10		
	Low					1		2		3		
	Area outside the visual corridor of major hwy's										L	
	High											
	Medium				3		7	2		12		
	Low	5	1	6		1				16		

(Instructions on reverse)

Form 6110–10 (August 1972)

Area within the visual corridor of State Highway 200A--20,000 visits/yr. min.

Area within the visual corridor of State Highway 31--20,000 visits/yr. min.

Area outside the visual corridor of major highways--NA

Use association is the use of areas adjacent to the major recreation area or primitive areas such as Lake Sakakawea and the Missouri River, particularly the travel-routes to these areas. The following measures the relationship to these areas in relative important.

Area within the visual corridor of State Highway 200A--Major

Area within the visual corridor of State Highway 31--Major

Area outside the visual corridor of major highways--Minor

Community Attitudes are the attitudes of the community(ies) in regard to the visual resource. In particular the attitudes of the farmer, agricultural or rural people were taken into consideration. For the entire county's community attitude it was felt that protection of the visual resource is neutral.

Land Use (Non-BLM) is the land-use management attitudes of the coal mining companies with respect to the management of the visual resources. In all cases, it was felt that their attitudes were low particularly during short term operations (mining).

Other Agency Use and Attitudes are the attitudes of other agencies towards the visual resource. Attitudes of such agencies as the State Outdoor Recreation Agency and the State Game and Fish were considered where attempting to determine the visual sensitivities of the following areas:

Area within the visual corridor of State Highway 200A--Major

Area within the visual corridor of State Highway 31--Secondary

Area outside the visual corridor of major highways--Secondary

Snowmobiler's and off-the-road vehicles (ORV) user's attitudes are their attitudes toward the visual environment. It was considered that this group of user's attitudes was more concerned with their physical use of areas than the protection or retention of visual resource values. Therefore, all areas were considered to be low visual sensitivity areas except where their use is greatest in areas outside the visual corridors of major highways, is considered medium visual sensitivities.

Visual Zones were delineated with sensitivity areas. The foreground/middleground zones are the same as areas within the visual corridors of state highways 200A and 31. Areas outside the visual corridors of major highways are considered medium visual sensitivities.

Using BLM Manual 6310, the Scenery Quality, Visual Sensitivity Analysis and Visual Zones were converted into Visual Resource Management (VRM) classes.

APPENDIX 2, FIGURE 1, Page 8 of 8

METHODOLOGY: SCHOOL ENROLLMENT COMPUTATION

The methodology used to compute the number of students in the Mercer-Oliver area that are estimated to be dependents of direct and indirect workers associated with the Glenharold Mine was based on the following assumptions:

1. The population/student ratio for the Glenharold Mine associated population is the same as that for the Mercer-Oliver County area. The student population comprises 24 percent of the Mercer-Oliver population.
2. The population (direct and indirect workers and families) associated with the Glenharold Mine was computed to total 1,380. (See population section of Economics component for population computation.)
3. Total students: 1,380 x .24 = 331.

APPENDIX 2, FIGURE 2

Appendix to Chapter 3

VISUAL RESOURCE MANAGEMENT

Visual Contrast Rating

The analysis of impacts on visual resources are based on procedures contained in Bureau of Land Management Manual 6320.

The ease of detecting contrast varies according to the following scale: 4 (form); 3 (line); 2 (color); and 1 (texture). Assigning values to indicated degree of contrast (3 for strong, 2 for moderate, and 1 for weak) permits the establishment of a direct multiplier for indicating the strength of the contrast.

Standards

The contrast rating can be used as a measurement of a standard to be met within Visual Resource Management Classes.

The following is applied to determine if the proposed activity will meet the visual resource management class assigned to the area.

Class I. The degree of contrast for any one element may not exceed 1 (weak) and the total contrast rating for any feature must be less than 10.

Class II. The degree of contrast for any one element should not exceed 2 (moderate) and the total contrast rating for any feature may not exceed 10.

Class III. The degree of contrast for any one element should not exceed 2 (moderate) and the total contrast rating for any feature may not exceed 16.

Class IV. The total contrast rating for any feature should not exceed 20.

Class V is an interim classification for rehabilitation or enhancement of an area. Based upon its indicated potential visual resource management class (II, III, or IV), select the appropriate contrast rating.

Analysis. In order to describe the potential visual impact of a proposed project, it is necessary to be able to quantify the expected change in landscape character. The following analysis was used to relative impacts:

a. If the contrast rating scores meet the requirements for the VRM Class, the visual impact would be considered *insignificant.*

b. If the contrast exceeds the requirement for one or more elements but not for the feature, the impact would be considered *moderate.*

c. If the contrast exceeds both the element and feature requirements, the impact would be considered *severe.*

The following tables are the contrast ratings for the period of active mining (Table 1) and following reclamation.

APPENDIX 3, FIGURE 1, Page 1 of 2

TABLE 1

CONTRAST RATING DURING MINING

	Element		Contrast		Score	Maximum Possible Score
Land Surface Features	Form-4	x	Strong-3	=	12	12
	Line-3	x	Moderate-2	=	6	9
	Color-2	x	Moderate-2	=	4	6
	Texture-1	x	Moderate-2	=	2	3
			SUBTOTAL		24	30
Vegetation Features	Form-4	x	Moderate-2	=	8	12
	Line-3	x	Weak-1	=	3	9
	Color-2	x	Moderate-2	=	4	6
	Texture-1	x	Weak-1	=	1	3
			SUBTOTAL		16	30
Structure Features	Form-4	x	Moderate-2	=	8	12
	Line-3	x	Strong-3	=	9	9
	Color-2	x	Moderate-2	=	4	6
	Texture-1	x	Weak-1	=	1	3
			SUBTOTAL		22	30
				TOTAL	62	90

TABLE 2

CONTRAST RATING AFTER RECLAMATION

	Element		Contrast		Score	Maximum Possible Score
Land Surface Features	Form-4	x	Weak-1	=	4	12
	Line-3	x	None-0	=	0	9
	Color-2	x	None-0	=	0	6
	Texture-1	x	Weak-1	=	1	3
			SUBTOTAL		5	30
Vegetation Features	Form-4	x	None-0	=	0	12
	Line-3	x	Weak-1	=	3	9
	Color-2	x	Weak-1	=	2	6
	Texture-1	x	None-0	=	0	3
			SUBTOTAL		5	30
Structure Features	Form-4	x	None-0	=	0	12
	Line-3	x	Weak-1	=	3	9
	Color-2	x	None-0	=	0	6
	Texture-1	x	None-0	=	0	3
			SUBTOTAL		3	30
				TOTAL	13	90

METHODOLOGY - GROSS BUSINESS VOLUME ESTIMATION

Estimates of the gross receipts multipler for North Dakota's retail sector and household sector are 2.09 and 3.08, respectively. This means, for example, that a dollar spent in the retail sector will ultimately result in a total increase of $2.09 in the North Dakota economy after that dollar has been spent and respent in the course of a year. The gross receipts multipliers result from the input/ output model developed by North Dakota State University. Consequently, the ultimate increase in North Dakota's gross business volume (i.e., final demand) attributable to Consolidation Coal Company's local annual purchases of $374,974 is $783,696 ($374,974 x 2.09). Similarly, the final increase ingross business volume attributable to the company's annual payroll of $2,948,000 if $9,079,840 ($2,948,000 x 3.08). Totaling the two final demand figures, it is estimated that Consolidation Coal Company's purchases and payroll in the two county area generate approximately $9,863,536 annually within the state of North Dakota ($9,079,840 $783,696).

APPENDIX 3, FIGURE 2

Appendix to Chapter 8

RELOCATION METHODOLOGY

Assumptions

1. Cessation of mining means that 156 employees at the Glenharold Mine site will no longer be employed at that site.
2. Eighty-seven percent of the direct workers are married and have families, the average family size is 3.67 persons (Leholm 1975).
3. One hundred percent of the indirect workers are married and have 3.25 people per family (estimate of family size from 1970 Census, North Dakota).
4. There are 1.7 indirect workers per direct worker (Toman and Dalsted 1976).
5. Thirty percent of the direct workers and 25 percent of the indirect workers ffected from assumption 1 will move from the Glenharold area.

The assumption that 30 percent of the 156 employees at Glenharold will relocate and commute to the new mining job is based on the following considerations:

a. Approximately 80 percent of the employees are long time residents of the area and may to some extent resist leaving.

b. Little additional housing exists elsewhere in the two county area.

c. Union employment virtially guarantees that employees in the expanding coal production industry will find employment elsewhere within the area.

The assumption that 25 percent of the indirect employees attributable to the Glenharold activity will lease the area was bsed on the following considerations:

a. The majority of these people are long term residents.

b. Little housing is available to move into elsewhere in the two counties.

c. Indirect employment occurs mainly in sectors which would gradually decline. A lag would exist unlike ann abrupt termination of mine employees and would allow a gradual readjustment to other sectors of employment.

The following calculations are based on the above assumptions and are used in the social and economic conditions analysis.

POPULATION IMPACTS - RELOCATION

Direct:	156 x .87 = 136	156 - 136 = 20 (single)
	136 x 3.67 =	499 (married/family)
		519
	519 x .30 =	154 (will relocate)
Indirect:	156 x 1.7 =	265 (total indirect affected)
	265 x 3.25 =	861 (married/family assuming 100% married)
	861 x .25 =	215 (will relocate)
Total individuals relocating =		369 (154 + 215)
Total direct and indirect population =		1,380 (519 + 861)

APPENDIX 8, FIGURE 1

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☆ GOVERNMENT PRINTING OFFICE: 1979 — 698-281

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